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LARGE SCALE MANUFACTURING.

The annual report of the General Electric Company, figures from which are quoted elsewhere in this issue, is a most striking and interesting document. It reveals a wonderful expansion of business during the past year, yet the limit of growth was not reached even then, for the first months of 1907 have shown further gains of 50 per cent. It is of course to be understood that such gains are rather in values than in quantities, owing to higher cost of material and labor; but on the other hand the price of heavy electrical apparatus has for a decade tended steadily downward in proportion to the increase in size of the unit. Dynamos will never be so expensive again as they were in the old days when a 50-lighter arc was a big machine and an incandescent dynamo for 1000 lights was spoken of with respect. This report speaks of turbo-generator units of 9000-kw nominal rating; induction motors of 6000-kw and transformers of 7500-kw. The tendency toward a reduction of price would be found to extend also into detail apparatus owing to the enormous quantities.

The total value of electrical products in 1890, when virtually all the constituent members of the General Electric system were in existence, was just over $19,000,000. Here we have a report for that one concern alone of $60,000,000 for 1906. But that is far from telling the whole story. The Western Electric Company, thanks to the boom in telephony, reached $69,000,000, and the Westinghouse total exceeded $40,000,000. Thus three companies had an output of $150,000,000, but there were 780 other producers left, some of them notably heavy producers in their respective branches, and if they doubled this figure it would be no great matter of surprise. On the whole such reports show that the electrical industries have already got very close to the fundamental necessities of the country in regard to light, heat, power, traction and the transmission of intelligence; and the assumption or prophecy of continued growth even at present rates is not improper or extravagant. What a revolution in other fields of manufacturing is implied in the fact that this one concern made over 40,000 power motors in the year of 565,000-hp capacity!

THE UNITS OF LUMINOUS INTENSITY.

The last issue of the *Bulletin* of the Bureau of Standards contains a valuable summary by Dr. Hyde of present knowledge of this subject. It is most unfortunate that there is no international primary standard now generally accepted. There have been several praiseworthy attempts at standardization which have uniformly come to naught, through lack of real international cooperation. It is futile for bodies representing one particular set of interests to attempt to deal with a general question of this sort, and the result of such efforts has been rather to confirm a multiplicity of standards than to establish any one of them. Secondary standards offer an easier problem. Dr. Hyde's study of this subject included the measurement at the English, French and German official laboratories of 12 incan-

descent lamps from our Bureau of Standards, and the results were altogether gratifying as regards general precision. Broadly, it was shown that such lamps standardized at any of these laboratories may be relied upon to within about one-half per cent, as regards relative values. That is, an incandescent lamp duly standardized at any of them can probably be taken to any other, and will check within this degree of precision in spite of different apparatus, methods and observers, and of possible changes in the lamps. It is to be noted that the results with stationary lamps run in a marked position were decisively better than with rotating lamps, as regards consistency of results.

The absolute standards of the several countries cannot, however, be regarded as known within this degree of precision. The primary standard in Germany is, of course, the Hefner lamp; in France it is practically the Carcel lamp, and in England the 10-cp Harcourt pentane lamp. The literal Parliamentary candle is a doubtful quantity and the Violle platinum standard is unhappily also in ill repute. In this country we are in the curious position of having the candle as the only standard of any legal force, while the practically used standard is the incandescent lamp determined by direct or indirect reference to the Hefner. The Carcel has been pretty carefully compared with the Violle standard, while the Harcourt lamp is supposedly equal to 10 Parliamentary candles. The primary unit of luminous intensity must at present rest as a compromise between the three lamps considered, and the fundamental question just now is, first, the degree of consistency thus attainable, and second, the sufficiency of incandescent lamps used as gobetweens. As is probably known to our readers, the ratio between the British candle and the Hefner has been put in doubt by recent experiments. The usual assumption of 0.88 has appeared from all the recent measurements to be in error. The value obtained by Dr. Hyde from the Bureau of Standards lamps is 0.893 and other values range still higher up to one of .93 obtained by direct comparison of the Hefner and Harcourt lamps. Such comparison involves, of course, to a certain extent the question of reproductibility of these lamps, since the examples compared were necessarily not the individual lamps or groups of lamps regarded in Germany and England as the primary laboratory standards. On the other hand, if the lamps concerned lack of being reproducible by several per cent, they are in a bad way as primary standards.

The cause of the discrepancy remains to be determined. It looks very much as though the early British candle had undergone some slight practical variation or had not been properly corrected in the earlier experiments. At present its nominal value is at variance, by one or two per cent certainly, from the nominal candle used in American photometry. The differences in ratio between the Hefner and the Carcel are very much smaller, yet in the extreme they rise to about 1.5 per cent. Oddly enough, here again the later experiments are at variance with those reported four years since by Dr. Bunte, and in the same direction as in case of the Harcourt lamp. The ratios between the Harcourt lamp and Carcel vary, again, in the same fashion, by 5 per cent. It is therefore clear enough that while the comparison of incandescent lamps can be carried out at any time or in any suitably equipped laboratory with good precision, the reference of intensity to the primary standards in use is in even worse case than had been supposed. From the nature of the discrepancies we are inclined to think that the best method of throwing light upon them would be to start a group of incandescent lamps from, say, the Bureau of Standards on a round of the other laboratories to be compared, not with standard incandescents in each place, but with the primary standards directly. There is a chance for errors due to color difference in such case which disappears in comparing incandescents with each other. Such errors if they exist would probably crop out in these comparisons. The question involved is the sufficiency of incandescents as measures of absolute intensity in comparing lights varying as much in color as the Hefner and the Harcourt. Is the possible color difficulty reduced or not by comparing an incandescent with each instead of facing the difficulties of reproduction plus one direct comparison? It seems at first thought that an incandescent worked at the proper color would serve as an admirable unit-carrier, but some experimental confirmation of this view is extremely desirable.

Reduction of Life of Lamp by Frosting.

In our issue for March 17, 1906, an article by Messrs. Cravath and Lansingh called attention to the diminution in useful life of incandescent lamps occasioned by enclosing them in diffusing globes or by using acid frosting on the lamp bulb. The experiments reported seemed to indicate that the loss of the so-called "useful life" by enclosing them in globes was about 5.5 per cent, while the loss by frosting was about 52 per cent. It is worthy of note in this connection that the large seeming difference in life is to be attributed in part to a rigid adherence to the rule which states that a lamp ceases to be useful when its candle-power has decreased to 80 per cent of its initial value after the diffusing devices have been applied, without any reference whatsoever to the final value of the watts per mean spherical candle-power, or, in other words, to the economic "smashing point." However, the facts which interest us at this time relate not so much to the definition of the term "useful life" as the causes for the rapid change in candle-power when the lamp bulb has been frosted. A valuable series of experiments undertaken with the purpose of locating the above-mentioned causes was reported by Mr. Preston S. Millar in an article in our issue for April 20, 1907. From these tests Mr. Millar concluded that a change in the filament is responsible for a decrease to 97.1 per cent of the initial candle-power (after frosting); the blackening of the bulb further reduces the candle-power to 92.0 per cent of the initial; the additional absorption to which the frosting subjects a portion of the light still further reduces the candle-power to 86.9 per cent of the initial value, and the final reduction to 80.1 per cent of the initial is occasioned by dust.

In an article on page 987 of the present issue Dr. A. E. Kennelly derives certain formulas for expressing the reflection and counter-reflection of light from the frosted surface internally, and the light emitted externally, in terms of the transparency of the glass, and finds that the formulas serve for explaining the results obtained by Mr. Millar, when proper constants, based on Mr. Millar's tests, are introduced. According to Dr. Kennelly's formulas, as the walls of the lamp become blackened, not only is there a decrease in the light which reaches the outside directly from the filament, as is true in the case of a clear lamp, but the light inwardly reflected from the outer side of the glass at the frosted surface is absorbed to a larger and larger extent as the black deposit increases. It would seem, therefore, that the increase in the rapidity of diminution of the

candle-power of a lamp when it is frosted is not occasioned by the outer surface of the glass acting as a dust collector, but is attributable to the inner surface as a repository for particles thrown off from the filament; hence it depends largely upon the character of the filament and should be zero for a filament which does not disintegrate. It would be extremely interesting to learn what effect frosting has on the life of metallic filament lamps and lamps of the Helion type.

MEASUREMENTS OF CURRENTS ON TELEPHONE CIRCUITS.

The telephone circuit is the circuit of the microampere, just as the electric lighting main circuit is the circuit of the kiloampere. But both circuits carry amperes to some scale, and it is merely a matter of degree. The effects produced are very different, but the fundamental laws obeyed are the same. It is not easy to measure the strength of current which flows through a telephone circuit, owing to its minuteness. Nevertheless, the measurement can be made. We know that a current of one milliampere is a very strong telephone current for talking purposes, and that on long telephone circuits the talking current strength may not be more than 20 or 30 microamperes, as measured by the square root of the average square. We also know that the loudness of the sound in the listener's ear is not in proportion to the strength of the current, but in a much lower, although definite proportion. The *Elektrotechnische Zeitschrift* has recently published an article by Herr Béla Gáti upon telephone-current measurement with the aid of a certain improved form of barretter, in conjunction with an indicating galvanometer. The details of the instrument are not given, but a gold Wollastonwire is mentioned as being used for the production of the barretter. The instrument is, of course, capable of being used for a variety of telephonic measurements. The principal measurements described in the article are those of electrostatic capacity in telephone cables. It is stated that the capacity of telephone cables measured at frequencies such as 2000 cycles per second are distinctly less than those measured at lower frequencies. This is a reasonable proposition, but the ratio of diminution with frequency is not generally understood and researches on this question would be of considerable practical interest.

There is great need of further research in the field of telephonic currents under industrial conditions, to show the effects of frequency of alternation, as well as a host of other incompletely determined phenomena. The behaviors of kiloamperes and of ampere delivery are known fairly well, because it is so easy to measure such currents. But with microampere delivery, we only go by the ear, which is a most admirable device from a qualitative standpoint; from a quantitative standpoint, however, the unaided ear is a most imperfect instrument, and the difficulties of measurement stand in the way of the aggregation of data. Herr Béla Gáti also gives somes barreter tests of telephone transmitters at different frequencies. The tests indicate that different types of microphone transmitter differ considerably in their telephonic current production not only at one and the same frequency, but also at different frequencies. A large and inviting field of investigation lies open to the barretter in such transmitters.

THE PLOTTING OF SPEED-TIME CURVES.

If we go on board an electric car which has been arranged for testing by connecting some form of speed-indicator or revolution-per-second counter to one of the axles it becomes a very simple matter to plot a curve of car speed against time, or a speed-time curve. All that is required is a set of observations of speed at successive intervals of time after starting. In fact, there are recording instruments which automatically plot the speed-time curve of a car. They are essentially timekeepers combined with speed-recording apparatus. But before the cars have been built, and when the electric railway is merely projected, the case is very different. The engineer who designs the road has only a profile chart of the road and an improvised schedule of car service. He estimates the dimensions and weights of the cars with their hoped-for loads of humanity. What type of motors on the car axles will then satisfactorily comply with the schedule? On country street railway lines it has been customary in the past to apply motors such as experience showed were reliable, and make up the schedule from trial runs with the cars over the route. This is like buying a naphtha engine on its general appearance in the salesroom, installing it on a launch, trying how fast the launch will then go, and changing the engine if the speed is not satisfactory. In competition with steam-railroad lines, however, the schedule must be adopted in advance and the electric railway engineer must be able to run the cars on schedule time, as soon as they are put on trial. The manufacturers of railroad motors provide test sheets of guaranteed performance. These test-sheets indicate for any given speed of the motor, running under constant voltage, what will be the tractive effort. This tractive effort, for a given number of motors, weight of car, nature of track, and gradient, determines the acceleration of the car at that speed. As the speed increases, the acceleration will diminish if the motor is afloat on the mains, *i. e.*, without rheostatic control. Consequently, the engineer can ascertain the acceleration of the prospective car on the route, but is not directly informed concerning the intervals of time between successive speeds, so that he cannot plot the speed-time curve of the car offhand from these data. When running at 20 miles an hour the acceleration will be, say, one-quarter of a mile-per-hour-per-second, and when running at 30 miles an hour, perhaps one-eighth of a mile-per-hour-per-second. But how many seconds will the car take to climb in speed from 20 to 30 miles an hour?

There are several ways of assigning in advance the times to the speeds of a car, knowing their corresponding accelerations. They are usually graphic methods affected with considerable uncertainty. Prof. A. S. Langsdorf communicates an improved graphic method in his article on page 989 of this week's issue. In this method the speed is first plotted rectilinearly as a function of the acceleration. Tangents are then drawn to this curve at suitable intervals. The successive tangent slopes are each divided by the acceleration corresponding thereto. A new curve of the quotients is then plotted rectilinearly as a function of the acceleration. The area over this curve is proved to measure the time of passage from any one acceleration to another, thus permitting the proper times to be assigned to any or all accelerations and also to any or all attained speeds. In this way the speed-time curve of the car may be arrived at. The method depends for its degree of accuracy upon the precision of the graphical process, but is rigid on the assumption that the graphical process is accurate. It should be more satisfactory than the common method of erecting slants on speed ordinates and spreading the latter apart until the slants look as though they met.

Figures from the General Electric Annual Report.

The fifteenth annual report of the General Electric Company has just been issued, giving statistics as to a remarkable year of growth, activity and prosperity. It contains the individual reports of President Coffin, Vice-President Griffin, Vice-President Rice, and Treasurer Darling, with balance sheets, schedules of property, etc. As will be seen, the company did a business of over $60,000,000 in the twelve months. According to Mr. Coffin, this was $17,000,000 more than in 1905, or an increase in shipments of about 40 per cent. Mr. Coffin also states that the sales this year have been 50 per cent greater than in 1906, and thus, if such growth continues, additional capital will be required.

The net profits of the company are reported by Mr. Coffin as being, net $8,427,842. Out of this dividends were paid to the amount of $4,344,342. From this was written off $999,999 on account of patents, franchises and good will, and $3,083,501 was carried to surplus, making, with previous surplus, a total on January 31, 1907, of $15,110,796.

First Vice-President Griffin—now deceased—gives in his report very interesting data as to the gross business. The comparison with previous years was as follows:

Year ending Jan. 31.	Amount Billed.	Orders Received.
1902	$32,338,036	$34,350,840
1903	36,685,598	39,944,454
1904	41,699,617	39,060,038
1905	39,231,328	35,094,807
1906	43,146,902	50,044,272
1907	60,071,883	60,483,659

"Orders received" include only apparatus manufactured by the General Electric Company, and do not include such items as services of experts, labor of installation, freight and transportation, supply material, boilers, engines, etc., of outside manufacture, and bare copper wire. All these items are included in "Amount billed." In the last ten years the amounts billed have increased from $12,540,994 in 1896, to $60,071,883 in 1906, an average increase of 17 per cent per year.

It is stated that during the year turbo-generators of an aggregate 350,000 horse-power were sold, and that large numbers were shipped all over the world. On April 1 the company had already put 110 multiple unit electric trains and 30 electric locomotives in use on the New York Central Railroad. During the year supplies sales increased 35 per cent, and no fewer than 40,365 stationary motors, aggregating 565,000 horse-power were sold. Outside of contracts, no fewer than 235,028 supply orders were received, or 783 per working day. Sales of large apparatus increased, and show the same tendency as heretofore towards larger sized units. The maximum sizes in various lines are:

Units.	Nominal rating.	Overload capacity.
Turbo Alternators	9000 kw	13500 kw
Water Wheel Generators	7500 kw	11250 kw
Direct Current Generators	2700 kw	4000 kw
Induction Motors	6000 kw	9000 kw
Transformers	7500 kw	11250 kw

Vice-President Rice, at the head of production gave the following data as to the factories and the number of factory employees during the last five years:

	Floor Space.	Employees.
1903	3,000,000	18,000
1904	3,700,000	17,000
1905	4,100,000	18,000
1906	4,350,000	22,500
1907	4,770,000	28,000

The land area of all three plants is now about 445 acres. The total book value of all the land and buildings (excluding machinery, etc.), of the Schenectady, Lynn and Harrison factory plants is $5,363,812.88, or about $1.12 per sq. ft. of manufacturing floor space of the buildings. In all the factories important extensions are planned or under execution, and no note is made of the new factories at new points. At the Harrison works, a building with 60,000 sq. ft. has been put up for the manufacture of high efficiency metallic filament lamps.

Mr. Rice makes note also of some of the novel features of engineering connected with the year's business, and the following paragraphs may be quoted:

"The size and voltage of transformers for use in long distance transmission work continues to increase. We are now building on order a number of transformers of 7500 kilowatt capacity, for operation at 104,000 volts. Our high tension switching apparatus has been still further developed during the year; one notable instance has been the design and successful testing of a switching device for 100,000 volt operation.

"Our engineers have completed the design of a line of direct-current railway motors containing important novel features. Practical tests have shown these new motors to be superior to existing standards in economy, commutation and ability to operate at higher and more economical voltages.

"An interesting and important application of electricity is found in the reduction of metals. During the present year we have sold to one customer for use therein, 28 machines of a total capacity of 74,000 kilowatts. These machines are the largest direct-current generators in existence, were especially designed by us for the purpose, and those already completed have proved to be entirely successful.

"The vertical shaft design which has proved so successful in our large turbines has been applied to the design of motor-generators and rotary converters. This vertical arrangement effects a considerable saving of space and money, and is particularly desirable for use in sub-stations in large cities. We have sold a number of such vertical sets for operation in Chicago and other places.

"Electric motors in industrial establishments continue to increase both in numbers and in variety of applications. An interesting case involving the use of very large motors of special design is that of driving rolling mills in the manufacture of steel. We have several contracts in which the motors for driving the mills average about 10,000 horse-power capacity each."

Treasurer Darling in his very full report notes several important facts. One is that the company spent in 1906 no less than $785,594 in patents, licenses and patent litigation. The stocks and bonds issued by the company have a book value of $20,086,790, and during the year it sold for $843,155 securities it had carried at a value of $513,452, showing the handsome profit of $329,702. The total stock issued and subscribed was $65,134,300, and authorized but not yet issued $14,865,700. The balance sheet shows in notes and bills receivable, $22,863,788; a merchandise inventory of $22,593,907; factory plants at $9,000,000, and a cash balance of $3,910,708. Work in progress represented $3,853,321.

Mechanical Engineers' Spring Meeting.

The spring meeting of the American Society of Mechanical Engineers will be held in Indianapolis, Ind., May 28-31, with headquarters room in the Claypool Hotel. A number of excursions to points of interest in and around Indianapolis have been arranged. After the opening session on Thursday evening, May 28, at which President Hutton will deliver a presidential address, an informal reception will be held which will give an opportunity for members and guests to meet and exchange greetings.

Following is the programme of papers:

WEDNESDAY, MAY 29.

Morning.—"Report of the Committee on Standard Proportions for Machine Screws." "Preliminary Report of the Committee on Refrigerating Machines." "Collapsing Pressures of Lap-Welded Steel Tubes," by Reid T. Stewart. "The Balancing of Pumping Engines," by A. F. Nagle. "A Comparison of Long and Short Rotary Kilns," by E. C. Soper.

Afternoon.—"Bearings and Moving Mechanism," by Henry Hess. "Air Cooling of Automobile Engines," by John Wilkin-

son. "Materials for Automobiles," by Elwood Haynes. "Special Auto Steel," by T. J. Fay. "Railway Motor Car," by B. D. Gray.

THURSDAY.

Morning.—"The Specific Heat of Superheated Steam," by A. R. Dodge. "Determination of Entropy Lines for Superheated Steam," by A. M. Greene. "The Flow of Superheated Steam in Pipes," by E. H. Foster. "Co-relation of Furnace and Superheated Conditions," by R. P. Bolton. "The Heating of Store Houses," by H. O. Lacount.

FRIDAY.

"Performance of Cole Superheaters," by W. F. M. Goss. "Experience with Superheated Steam," by G. H. Barrus. "Use of Superheated Steam on Locomotives in America," by H. H. Vaughan. "Superheated Steam in an Injector," by S. L. Kneass. "A Hirn's Analysis of Locomotive Test," by S. A. Reeve.

N. E. L. A. Programme.

The programme of the Washington convention of the National Electric Light Association is the most formidable in the history of that organization. Below we give the preliminary schedule of papers, which is subject to additions. The executive officers of the various convention committees are as follows:

General committee, Mr. Dudley Farrand, Newark, chairman. Reception committee, Gen. George H. Harries, Washington, chairman. Entertainment committee, Mr. H. W. Fuller, Washington, chairman. Hotel committee, Mr. E. S. Marlow, Washington, chairman; Mr. E. E. Bondy, New York, vice-chairman. Advertising committee, Mr. Cyril Nast, New York, chairman; Mr. George P. Manger, New York, vice-chairman. Exhibition committee, Mr. L. E. Sinclair, Washington, chairman; Mr. Walter Neumuller, New York, vice-chairman. Committee on engineering plans, Mr. Philip Torchio, New York, chairman. Committee on automobiling, Mr. J. M. Stoddard, Washington, chairman. Transportation committee, Mr. George F. Porter, New York, chairman. Programme committee, Messrs. Arthur Williams, New York; H. W. Fuller, Washington; J. Robert Crouse, Cleveland. Chief of Registration bureau, Miss Edith M. Myers.

On Monday morning, June 3, there will be a reception in the New Willard Hotel, followed by dancing, music to be furnished by a section of the Marine Band. On Tuesday morning there will be an automobile ride, and in the afternoon a trolley ride to Cabin John Bridge, for the ladies. On Wednesday morning there will be an automobile ride for the ladies and in the afternoon an exhibition cavalry drill at Fort Myer. In the evening Dr. Steinmetz will deliver a lecture, following which there will be a ball at the New Willard. An automobile ride on Wednesday morning will be followed by a visit in the afternoon of the ladies to Mount Vernon, and in the evening to the Congressional Library. On Friday morning there will be the usual automobile ride for the ladies.

The opening session of the convention will be called to order at 10 a. m., Tuesday, when after an address of welcome and the president's address, the programme of papers will be taken up. Following is the list to date of the papers and reports to be presented in public sessions:

TUESDAY.

Morning.—Report of Committee on Progress, by Mr. T. Commerford Martin, New York. Accidents, by Mr. Paul Lüpke, Trenton, N. J. The Effect of Frosting Incandescent Lamps, by Dr. Edward P. Hyde, Washington, D. C. Need for an Accurate Maximum Demand Meter for Measuring the True Energy of Polyphase Service; A discussion led by Mr. Louis A. Ferguson, Chicago, Ill.

Afternoon.—Legal Justification for Differential Rates, by Mr. Geo. Whitefield Betts, Jr., New York. Recent Developments in Mercury Rectifiers, by Mr. Frank Conrad, Pittsburg. Report of Committee on Standard Rules for Electrical Construction and Operation, by Mr. Ernest H. Davis, Williamsport, Pa., chairman. Report of Committee on the Fire Hazard of Electricity, by Mr. C. E. Skinner, Pittsburg, chairman. Report on Insurance and Kindred Matters, by Mr. W. H. Blood, Jr., Boston, insurance expert of the association. Report of Committee on Electric Light Accounting, by Mr. H. M. Edwards, New York, chairman.

WEDNESDAY.

Morning.—Report of Committee on the Present Methods of Protection from Lightning and other Static Disturbances, by Mr. Alex Dow, Detroit, chairman. Recent Developments in Protective Apparatus, by Mr. D. B. Rushmore, Schenectady, N. Y. New Developments in Arc Lamps and High Efficiency Electrodes, by Mr. G. M. Little, Pittsburg. Report of Committee on Electric Heating and Cooking, by Mr. James I. Ayer, Boston, Mass., chairman. Electric Heating, by Mr. C. D. Wood, New York. The Future of the Gas Engine, by Mr. Lewis Nixon, New York. Producer Gas Engines for Central Station Work, by Mr. Robert T. Lozier, New York. The Frequencies of Flicker at which Variations in Illumination Vanish, by Dr. A. E. Kennelly and Mr. S. E. Whiting, Harvard University. Efficiency of Various Methods of Illumination, by Mr. E. A. Norman, New York. Report of Committee to consider Specifications for Street Lighting, by Mr. Dudley Farrand, Newark, N. J., chairman. (Dr. A. E. Kennelly will preside during the presentation and discussion of this report.)

Evening.—Lightning and Lightning Protection, by Dr. C. P. Steinmetz, Schenectady.

THURSDAY.

Morning.—Report of Freight Classification Committee, by Mr. Ernest H. Davis, Williamsport, chairman. Report of Committee on Relations between Manufacturers and Central Stations, by Mr. Henry L. Doherty, New York, chairman. Indefinite Candle-Power Ratings in Municipal Contracts and the Experience of the Colorado Springs Electric Company. Recent Turbine Developments, by Mr. W. L. R. Emmet, Schenectady. The Electric Automobile as an Adjunct to Central Station Load, by Mr. H. H. Rice, Indianapolis, Ind. Some Power Experiences, by Mr. S. M. Sheridan, Detroit, Mich. Municipal Ownership, by Mr. Arthur H. Grant, New York. Why We Failed in a Municipal Ownership Campaign, by Mr. Glenn Marston, New York. Italian Methods of Charging for Electric Current, by Signor Ing Guido Semenza, Milan, Italy. Report of Membership Committee, by Mr. J. Robert Crouse, Cleveland, chairman. Report of Committee on Relations with Local Associations, by Mr. S. R. Bradley, Jr., Nyack, N. Y., chairman. Report of Committee on the Grounding of Alternating Current Secondary Circuits, by Mr. W. H. Blood, Jr., Boston, chairman.

FRIDAY.

The papers to be presented on Friday, or "Commercial or New Business Day," are limited to 5 and 10 minutes each, and discussion to 3 minutes for each speaker.

Morning.—Scope and Character of Papers and Discussion, by Mr. W. W. Freeman, Brooklyn, N. Y. Report of National Electric Light Association Co-operating Committee, by Mr. W. W. Freeman, Brooklyn, N. Y., chairman. Co-operative Commercialism in the Electric Field, by Mr. J. Robert Crouse, Cleveland, Ohio. Possibilities of Commercial Development, by Mr. Henry L. Doherty, New York. New Business—How to Get It—How to Keep It, by Mr. F. M. Tait, Dayton, Ohio. New Business Results Demonstrated in Cities of All Sizes, by Mr. J. E. Montague, Niagara Falls, reporter. Sales Policy in Combination Gas and Electric Companies, by Mr. F. A. Willard, Rochester, N. Y. The Electrical Jobbers and Dealers Co-operation in Business Getting, by Mr. R. V. Scudder, St. Louis, Mo. Co-operation of the Electrical Trade Papers in Business Getting, by Mr. F. W. Loomis, Savannah, Ga, reporter. How to Get the Old Buildings Wired, by Mr. F. H. Golding, Dayton, Ohio. How to Get the New Buildings Wired, by Mr. J. Sheldon Cartwright, Knoxville, Tenn. Co-operation of the Electric Contractor in the Wiring of Buildings, by Mr. Jas. R. Strong, New York. Sizing Up the Territory—Preparing the Lists of Prospective Customers, by Mr. George Williams, Cincinnati, Ohio. Qualifications of

Solicitors for Different Classes of Business, by Mr. F. W. Frueauff, Denver, Col. How to Measure Results and Pay Solicitors, by Mr. Leon H. Scherck, Birmingham, Ala. Increasing the Efficiency of the Sales Force, by Mr. J. D. Kenyon, Chicago, Ill. Value and Use of Solicitors' Handbook, by Mr. R. S. Hale, Boston, Mass.

Afternoon.—A Balanced Advertising Programme, by Mr. Ralph Richardson, Jackson, Tenn. Advertising Results Demonstrated in Cities of All Sizes, by Mr. E. S. Marlow, Washington, reporter. How to Make the Most of Newspaper Advertising, by Mr. A. D. Mackie, Peoria, Ill. Measuring the Results of Advertising, by Mr. M. S. Seelman, Jr., Brooklyn, N. Y. Value of the Service of the Advertising Agency or Specialist, by Mr. Lawrence Manning, Owosso, Mich. Display Room and Demonstration as Business Getters, by Mr. E. R. Davenport, Providence, R. I. New Business by Indirect Methods, by Mr. L. D. Mathes, Dubuque, Ia. Illuminating Engineering as an Aid to Securing and Retaining Business, by Mr. C. F. Oehlmann, Cincinnati, Ohio. Methods of Securing Residential Business, by Mr. R. W. Hemphill, Ann Arbor, Mich. Co-operative Lighting of Streets by Merchants, by Mr. H. J. Gille, St. Paul, Minn. Methods of Securing Sign, Window and Outline Lighting, by Mr. Homer Honeywell, Lincoln, Neb. Methods of Securing Power Business, by Mr. Geo. N. Tidd, Scranton, Pa. Catering to Power for Automobile Charging, by Mr. R. W. Rollins, Hartford, Conn. Establishing Day Circuits in Towns of 10,000 Population and Under, by Mr. F. H. Plaice, New Bremen, Ohio. Methods of Exploiting Electric Heating Devices, by Mr. T. K. Jackson, Mobile, Ala. Review of Advertising, by Mr. C. W. Lee, Newark, N. J. Memorial, by Mr. T. C. Martin, New York.

Electrical Engineering at the University of Cincinnati.

Last year the University of Cincinnati inaugurated a six-year course in electrical engineering, which is additional to its regular four-year course. The new course is planned to give students alternate weeks of work at the university and at certain manufacturing works in Cincinnati. The shop work is so planned that the student follows the course of a machine from the raw material to the finished product. For instance, at the works of the Bullock Electric Company the students begin in the foundry, then go successively to the machine shop, commutator, controller, winding, assembly and testing departments, and ultimately into the draughting and sales departments. The Cincinnati manufacturers associated with this co-operative plan of education, at a recent meeting increased the scale of wages of student-apprentices in recognition of the excellent character of work they have been doing in the shops. The new scale begins at 10 cents an hour, and is increased at the rate of one cent an hour every six calendar months. The popularity of the new course is so great that the class for next year is already completed and many applications are on file for the class which enters in 1908. Prof. Herman Schneider is dean of the College of Engineering, and Prof. H. T. Eddy has charge of the electrical engineering department.

The Color Values of Artificial Illuminants.

At the meeting of the New York Section of the Illuminating Engineering Society, held on May 10, Mr. G. H. Stickney gave an experimental demonstration of the color values of artificial illuminants. By passing the light from an ordinary carbon arc lamp through a prism, a spectrum was thrown upon the screen. The lecturer was able thereby to demonstrate conclusively the distortion in color effects produced by the light of different colors. The difference in absorption of light, according to whether the color of the object was simple or was due to a mixture of colors, was well illustrated. The experiment relating to the ability of a body to reflect only those rays given out from the source of light which corresponds to the color of its surface, and which are contained in its own color, was beautifully illustrated. It was explained that, for example, a light deficient in red rays could not possibly show in its true color an object whose surface contains red.

On account of the fact that the color of light depends upon the frequency of vibration, the light may be changed in character by such means as may vary the frequency. One of the most common methods of changing the frequency is by varying the temperature. At a certain relatively low temperature an incandescent lamp filament appears dull red; as the temperature is increased its color changes to a light yellow, and finally becomes practically white. Not only is the light improved in color as the temperature is increased, but the illuminating efficiency is increased. The statement applies to all types of filaments. A limit to the temperature elevation is found in the disintegration of the filaments. The light which most nearly approximates pure white is that obtained from the carbon arc lamp, which is operated at the boiling point of carbon.

A striking comparison of the color value of the light obtained from Nernst lamps, carbon arc lamps, carbon filament lamps and Welsbach gas lamps, was given by arranging these illuminants in different compartments containing vari-colored cloths. It was easily seen that the light from the arc lamp was whitest, and showed up the colors most clearly in their daylight tints.

The discussion was opened by Mr. Leon Gaston, of England, who expressed the opinion that a large amount of education must be undertaken before the general public will appreciate the value of obtaining pure white light. He thought it possible that considerable danger resides in the use of illuminants of pronounced selective color effects on account of the tendency to produce color-blindness.

Mr. D. McF. Moore described the slow speed that has been made in improving the color of illuminants during the past century, the change being a gradual one, from light red, used in the early days, to almost white, demanded at the present time. Not until the flaming arcs were introduced was any attempt made to change the color of the light from the lamp. In such arcs, however, almost any color desired can be obtained. In the vacuum-tube lamp, also, it is possible to produce a large number of colors according to the gas introduced. The light which thoroughly reproduces daylight is obtained when carbon dioxide gas is used.

Mr. G. L. Hunter described observations showing that the illuminating efficiency of a lamp depends largely upon the relation of the color of the light to the color of the decorations used in the room. Thus, when the walls have a pink tint and the light is a pink color, the effect is very pleasing. When, however, the light is green and the walls are pink, the effect is discordant.

Mr. T. J. Litle explained that the particular type of Welsbach mantle which was used in the color-booth experiments was the one which fails to give life to the red colors. This seeming defect is overcome in other mantles by changing the composition of the mantle.

Dr. A. H. Elliott called attention to the great value of the lecture to the illuminating engineer from an educational standpoint, the experiments having been conducted in a way such as to leave no doubt whatsoever as to the conclusions to be drawn from them.

The secretary announced that an invitation from the Mayor of Boston and the Boston Section of the Illuminating Engineering Society to hold the annual convention in that city had been accepted. The convention will be held in the latter part of July or the early part of August.

Ohio Electric Light Association.

The Ohio Electric Light Association will hold its next, or thirteenth, annual convention at Toledo, Ohio, on August 20-22. One of the features of the arrangements for this convention is the publication of an elaborate souvenir programme, which will contain a short history of the association, the portraits of its officers and a number of engravings illustrating the principal objects of interest in Toledo.

Future A. I. E. E. Meetings.

The 219th and annual meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York, on May 21, at which time a paper will be read by Mr. Frank J. Sprague on "Facts and Problems Relating to Electrical Trunk Line Operation." At this meeting the secretary will announce the result of the balloting for officers to be elected this spring.

A special meeting under the auspices of the High Tension Transmission Committee of the Institute and the Chicago Branch will be held in the Auditorium Hotel, Michigan Avenue, Chicago, on May 24. The following introductions to discussions will be presented at that time: "Relative Merits of Three-Phase and Single-Phase Transformers," by H. W. Tobey. "Relative Advantages of Single-Phase and Three-Phase Transformers," by John S. Peck. "Forced-Oil and Forced-Water Circulation for Cooling Oil-Insulated Transformers," by C. C. Chesney. "Enclosed Station Wiring," by F. O. Blackwell. "Potential Stresses as Affected by Overhead Grounded Conductors," by R. P. Jackson.

The annual convention of the Institute will be held at Niagara Falls, N. Y., June 25 to 28. The preliminary list of papers is as follows:

"New Principles in the Design of Lightning-Arresters," by Prof. E. E. F. Creighton. "Some Power Transmission Economics," by F. G. Baum. "Notes on Transformer Testing," by H. W. Tobey. "One-Phase, High-Tension Power Transmission," by E. J. Young. "Fractional Pitch Windings for Induction Motors and Alternators," by Prof. C. A. Adams. "Short-Circuit Currents of Alternators," by Dr. C. P. Steinmetz. "Attitude of Technical Schools toward the Profession of Electrical Engineering," by Prof. H. H. Norris. "The Concentric Method of Teaching Electrical Engineering," by Prof. Valdemir Karapetoff. "Track-circuit Signaling on Electrified Roads," by L. F. Howard. "Method of Measurement in Lightning-Arresters," by Prof. E. E. F. Creighton. "Practical Testing of Commercial Lightning-Arresters," by Percy H. Thomas. "Engineering Specifications," by C. W. Ricker. "Vector Diagrams of Single-Phase Commutator Motor," by W. I. Slichter. "Application of Oil Switches in Power Transmission Work," by D. B. Rushmore. "Inductive Disturbances in Telephone Lines," by Louis Cohen. "Some Aspects of Parallel Operation," by B. A. Behrend, O. B. Field and J. M. Patitz. "Zigzag Leakage of Induction Motors," by R. E. Hellmund. "Deflocculated Graphite," by E. G. Acheson. "Regeneration of Energy from Electric Railway Motors," by William Cooper. "Switchboard Practice for Voltages of 60,000 and Upward," by S. Q. Hayes. "Power-Factor, Alternating-Current Inductive Capacity, Chemical and Other Tests of Rubber-Covered Wires of Different Manufactures," by Henry W. Fisher. "Interaction of Synchronous Machines," by Prof. Morgan Brooks.

The following topical discussions have also been arranged for the convention:

"Single-Phase versus Multiphase Generators for Alternating-Current Roads," and "Standardizing the Frequency for Alternating-Current Roads." Introduction to the discussion of the latter topic will be presented by Mr. A. H. Armstrong and Mr. N. W. Storer.

One entire day of the convention, June 26, will be devoted to the discussion of the following topics:

"Extra Insulation of End-Turns of Transformer Windings as a Substitute for Lightning-Arrester Choke Coils," by S. M. Kintner. "Extra Insulation of End-Turns of Transformer Windings as a Substitute for Lightning Arrester Choke-Coils," by Walter S. Moody. "Transmission Line Towers and Economical Spans," by D. R. Scholes. "Lightning Rods and Grounded Cables as a Means of Protecting Transmission Lines against Lightning," by Norman S. Rowe. "The Transmission Plant of the Niagara, Lockport and Ontario Power Company," by Ralph D. Mershon. "Location of Broken Insulators and Other Transmission Line Troubles," by L. C. Nicholson.

CURRENT NEWS AND NOTES.

ACCIDENTS IN DRESDEN.—Some years ago the city of Dresden, Saxony, offered a prize of $2,500 for the best apparatus to guard against street car accidents. The prize has been won by a merchant, whose apparatus has succeeded in catching up dogs and beer bottles placed in front of a car, without injury. Apparently these are the chief obstacles with which trolley cars have to contend in Germany. Here, in America, it is quite different.

FIRE LOSSES.—At the annual meeting of the National Board of Fire Underwriters a report was read in which it was stated that the loss of the fire underwriting institutions during 1906 was $114,255,285, or 46.56 per cent, in excess of the total premiums receipts. During the 10 years from 1897 to 1906, inclusive, the aggregate losses and expenses, together with increase in liability, showed an excess of $103,967,780, or 5.9 per cent, over the total premiums collected during that time. The total property loss in San Francisco was placed at $350,000,000 and the insurance loss of 243 companies at $175,508,530.

PORT HURON TUNNEL.—The tunnel under the St. Clair River between Sarnia, Ont., and Port Huron, Mich., will soon receive its electrical equipment which will consist of six single-phase Westinghouse locomotives. Overhead wires will be used in place of the third rail, and will be installed on steel towers with concrete foundations. The tunnel, which has been in use for steam traction for many years, will be cleansed, the interior painted white and well lighted by electricity. A power house is being built, which will contain two turbo-generators of 2000-hp capacity.

WESTERN SOCIETY OF ENGINEERS.—About 100 members of the Western Society of Engineers made a very enjoyable trip from Chicago to the State University of Illinois, at Urbana, on Saturday, May 11, in three special cars, leaving Chicago at 10 a. m., and returning at 9:30 p. m. The various engineering departments of the university had things of special interest to show. Mechanical engineers were interested in the fuel testing plant under Prof. Breckenridge, which is in continuous operation, and which consists of a Heine water-tube boiler with chain grate stoker and complete measuring appliances. In the electrical engineering department, Prof. Morgan Brooks showed a method of synchronizing two alternators without regard to their phase relation. It is accomplished by inserting in the circuit of the incoming machine a coil of wire without iron core. The coil used in synchronizing the 45-kw 440-volt, two-phase generator of the university power plant with the 120-kw unit, consisted of 30 lbs. of No. 8 wire wound into a coil about 2 ft. in diameter. The effect of the coil is like that of a spring preventing any serious jar. The cost of the coil is about $12, about 1 per cent of the cost of the machine to be synchronized. A coil is used in only one phase, and is cut out when the switch is closed, throwing both phases in together. The small reaction of bad synchronizing on the lamp load was no worse than the best possible manipulation without the coil. The first public demonstration was also made of a mechanical arrangement for illustrating to students the meaning of synchronism and phase relation. Two alternators with shafts in line were coupled through a beveled differential gear with an equal number of teeth. When the two machines are running at the same speed (in opposite directions) the frame holding the intermediate gear remains stationary. When the machines are synchronously driven by the same alternating current, this position is fixed at the four quadrants, which can, when once determined, be marked for future use in synchronizing. The first test was to start the two alternators, and synchronize them in the usual manner. The gear was immediately held in one or more of the four quadrant positions. The indicator on the gear may be safely used for timing the closing of the switch.

CORPORATIONS IN KANSAS.—It is stated from Topeka, Kan., that writs of ouster have been issued against the Western Union Telegraph Company and the Pullman Company by the Supreme Court of Kansas for not complying with the Kansas corporation laws. The ouster requires that the two companies must pay the charter fees required by the state before they can continue to do business here. It is expected that both companies will appeal the case to the Supreme Court of the United States. In the Pullman case the amount involved is about $19,000, and in that of the Western the amount is about $20,000. The suit was brought by the Attorney-General nearly two years ago.

THE DETROIT TUNNEL.—The Detroit Edison Company will furnish power for the Detroit River tunnel, now under construction. The electrified zone will extend over 4.8 miles with 15 miles of single track. There will be six 100-ton direct-current G. E. locomotives, each with four 280-hp geared motors, capable of hauling a 900-ton train 10 miles per hour on a 2 per cent grade. The Edison Company will deliver power to a sub-station at 4400 volts, 60 cycles, where two 1000-kw synchronous motor-generator sets will convert it to 650 volts, direct-current. Lighting will be supplied from alternating-current circuits. The yards and approaches will be lighted by arc lamps, and in the tunnel there will be duplicate circuits of incandescent lamps. The tunnel will be drained by five induction-motor, centrifugal pump outfits. A regulating storage battery will be installed in the sub-station.

HELMHOLTZ HYDROCEPHALOUS.—A special dispatch from Berlin of May 11 states that Prof. von Hanseman, the noted scientist of the Berlin University, has examined the brains of the late Theodor Mommsen, the historian; Hermann von Helmholtz, the physiologist, and Adolf Menzel, the painter. He declares that, according to the results of his investigation, while genius is not exactly akin to madness, these famous men possessed slight "water head" (hydrocephalous), and that this condition, for example, explains Menzel's extreme irritability and occasional fainting fits, and the chronic cramps from which Helmholtz suffered. Prof. von Hanseman also discusses how these men were able to work at extreme old age with their faculties apparently unimpaired—all lived and worked for over 70 years. He explains that with mathemeticians and atheletes, so with them—work becomes a second nature, a part of the individual. In other words, genius is nothing more than an indomitable inclination expressed through intense application.

HOWLINGS AT HOWELL.—A special dispatch from Howell, Mich., of May 3, says: "For the second time in three years a superintendent of the city lighting and water works has left town while his accounts were being investigated. The first man to leave was D. Hartnell, and he is supposed to be somewhere in Canada. He never came back. The latest man to leave without the knowledge of the Council is Willis Adams, Hartnell's successor. A tip reached members of the Council to-day that Adams had packed his household goods and had them awaiting shipment at the Pere Marquette depot. These men immediately hied to the freight house and found Adams' effects checked to Detroit. Adams and wife could not be located, and it was found out later that they had left town. Adams' effects are being held. It is stated on authority that there hasn't been a satisfactory statement made of the financial conditions of the commission for three years. At a special meeting of the Council recently it was decided to have an expert accountant go over the books. Considerable sympathy is expressed for Adams who recently fell from a telephone pole and is not in the best of health as a result. His friends say the books were in bad shape when he took hold of them, and have simply grown worse.

CANADIAN NIAGARA POWER.—It is understood that contracts are now being closed between the Canadian government, represented by the Hydro-Electric Power Commission, and the Ontario Power Company, whereby the latter company, situated at Niagara Falls, Ontario, is to supply between 25,000 and 100,000 horse-power 24 hours daily every day in the year to Canadian municipalities for a period of 10 years. Canada will supply the transmission lines, and government bonds will be issued to raise the money for this construction work. Fourteen cities in Ontario Province have filed application thus far for power, aggregating about 40,000 horse-power. Canada will pay $10.40 a horse-power at the transformer station at Niagara Falls, and will sell this energy at cost to the municipalities which will have charge of the distribution. The power company will realize about $1,000,000 annually from this contract, according to the present indications for contracts. The applicants and the quantities asked in horse-powers are: Toronto, 15,000; Toronto Junction, 4000; London, 6000; Guelph, 2000; Galt, 1200; Woodstock, 1200; Ingersoll, 1200; Stratford, 2500; St. Mary's, 750; Preston, 500; Berlin, 1000; Waterloo, 700; Hespeler, 300; Brantford, 2500. St. Thomas, which will require some 1200 horse-power, and Paris have not yet made formal application to the commission.

PRIVATE CAPITALISM NEEDED.—Mr. W. H. Mallock continues his interesting series of articles entitled, "A Critical Examination of Socialism," in *The North American Review.* In the May 3 number he takes up what Socialists call "wage-slavery" or "wagedom," and proves that "labor, as a whole, if we measure it by what it actually produces, has already been long receiving not less than it produces, but more." With regard to certain Socialistic experiments, he concludes: "Communities have been started from which private capitalism has been eliminated, and in which such ability as was attainable claimed no reward superior to that of ordinary labor. The majority of these communities, though made up of picked men, have not had a lifetime of more than two years. Some of them, however, have endured for a very much longer time, and thus give us a practical illustration of what labor can really do. One of these communities, after an existence of upwards of forty years, came to an end not very long ago, because the members became increasingly conscious of their own productive inefficiency, and such possessions and such capital as had been accumulated were divided among the members in so many equal shares. The share which came thus to each was only $1,300 dollars. A skilled mechanic, working under the directors of labor at Pittsburg, would be able to accumulate more, in the course of four or five years, than labor working by itself could accumulate in nearly half a century."

NATIONAL FIRE PROTECTIVE ASSOCIATION.—The New York offices of the National Fire Protective Association opened recently in rooms 815, 816, 817, at the Engineering Societies Building, 29 West Thirty-Ninth Street. These offices have become necessary on account of the increasing scope of the association's work, and the fact that this work has brought them prominently in contact with various important interests and manufacturers whose goods are built under their specifications, and whose headquarters are in New York City. The association offices will be shared by the Underwriters' Laboratories, of Chicago, which make, practically, all the tests for the National Fire Protective Association on various retardants, extinguishers, signalling and hazardous devices, which, in one way and another, affect various buildings, as concerns fire hazards. These offices will be equipped as rapidly as possible with all literature and information, specifications, etc., pertaining to these subjects, so that the interested public may be able to inform themselves exactly what is desired in order to conform to most modern ideas of fire engineering practice. The location of these offices in the Engineering Societies Building will also assist in bringing the insurance fraternity, through the National Fire Protective Association, in closer touch with the various prominent engineering societies located in the same building, and which societies are, of necessity, deeply interested in all work affecting building construction and equipment.

NEW PATENT COMMISSIONER.—The President appointed Mr. Edward B. Moore, of Michigan, to be Commissioner of Patents to succeed Frederick I. Allen, resigned. Mr. Moore has been on the staff of the Patent Office since 1883, latterly holding the position of assistant commissioner.

ENERGIZING THE OCEAN.—Last week Sir Hugh Bell, presiding at a meeting of the very serious and matter-of-fact Iron & Steel Institute, suggested that a century hence a ship with hardly any machinery or crew would speed across the Atlantic propelled by electric force generated by the Falls of Niagara and transmitted to the vessel wirelessly. Such a forecast, the speaker declared, was no more incredible than the developments of the past century. Sir Hugh is not aware that Niagara is to be preserved, and will therefore not be available but will be left to destroy itself.

GIFTS TO PRINCETON.—Last week announcement was made that Princeton had received a gift of $1,200,000 for the erection and maintenance of two scientific laboratories. The names of the donors are being withheld at present, but may be announced later. The gift provides $400,000 for the erection of a physical science laboratory and $200,000 for its equipment and maintenance. Similar amounts will be appropriated for a biological and geological laboratory. These buildings will probably be started in the summer, and when completed will fill a long-felt want of Princeton's scientific department.

NEW YORK TELEPHONY.—The telephone service and franchises of New York City were discussed before the Committee on City Affairs of the Republican Club last week, after a sub-committee had looked into the matter and prepared a long report. The burden of the report was that the New York Telephone Company was enjoying rights which it had not legally acquired. A paragraph in the report said: "We believe that the real point of attack on behalf of the interests of the City of New York and the taxpayers thereof should be directed against the real Gibraltar of the telephone monopoly, which now exercises under a claim or color of right, franchises and rights which are of value beyond calculation. We refer to the corporation known as the Empire Subway Company, Limited."

COLLEGE EXAMINATIONS.—At a meeting of the College Entrance Examination Board held at Columbia University last week, the Stevens Institute of Technology was admitted to membership, and announcement was made of the establishment of several competitive scholarships, among them the Frank Thomson Scholarship, open to the sons of employees of the Pennsylvania Railroad, and the Joseph T. Ryerson Scholarship of the American Railway Master Mechanics' Association. This latter is open only to applicants who have had at least 12 months' practical experience with the motive power or car department of a railroad. The next examinations will be held in the week of June 17 to 22, at about 150 points, including several places in England, France, Germany and Switzerland. It is expected that the number of candidates examined this year will be over 3000.

WHAT BUSINESS MEANS.—Mr. Andrew Carnegie is the subject of a very interesting interview in May *System* on what business really means, in the course of which he says: "If a young man does not find romance in his business, it is not the fault of the business, but the fault of the young man. Consider the wonders, the mysteries, connected with the recent developments in that most spiritual of all agents—electricity, with its unknown, and, perhaps, even unguessed powers. He must indeed be a dull and prosaic young man, who, being connected with electricity in any of its forms, is not lifted from humdrum business to the region of the mysterious. Business is not all dollars. These are but the shell—the kernel lies within, and is to be enjoyed later, as the higher faculties of the business man, so constantly called into play, develop and mature. Business to me has been a means to an end."

SINGLE-PHASE MOTOR.—A patent issued to Mr. Ralph D. Mershon on May 7, relates to improvements in the operating characteristics of single-phase machines possessing series motor characteristics. As is well known, the power factor, the cosine of the angle of lag, of such machines varies with the speed; in a well-designed motor the tangent of the angle of lag at synchronous speed is roughly equal to the ratio of the field turns to the effective armature turns, and it varies inversely with the speed. The usual method of improving the power factor of such a motor is to decrease the number of field turns or increase the number of the armature turns; that is, to build the armature magnetically strong compared to the field. The present inventor proposes to adjust the power factor by changing the synchronous speed; that is, by using a variable number of poles on the field and armature members. The circuits of the motor are so arranged that the number of poles may conveniently be varied during operation.

INDUSTRIAL FELLOWSHIPS.—Prof. R. K. Duncan has an interesting article on "Temporary Industrial Felowships" in the May 3 number of *The North American Review.* Science and scientific methods have done so much for German industry that Prof. Duncan urgently recommends a kind of alliance between industry and the universities by means of industrial fellowships to be established by manufacturers. He says: "The beneficence of the university extends not only to the solution of an industrial problem, but, also, to the furnishing of men. That 'good men' are scarce is, of course, a truism; but it is terribly apposite in these days. The modern manufacturer advisedly economizes in everything but salaries, and the very considerable salaries paid to good men is ample evidence of their rarity. Now, the purlieus of adolescent 'good men' are the laboratories of the university. There it is that men are 'tried out,' and there it is, too, that men are known better than they know themselves. When, therefore, the university accepts from a manufacturer the foundation of an industrial fellowship, it not only provides an expert intense attempt to solve a problem by the application of the newest of new knowledge, but, as well, it provides for that industry a 'good man,' whom the industry would do well to cherish, or, at any rate, the best man available."

THE WOODLAWN ACCIDENT.—The New York State Board of Railroad Commissioners has reported on its inquiry into the wreck of the Brewsters express, on the Harlem division of the New York Central Railroad: "The accident," says the report, "was the result of a track condition, plus speed, plus again the neglect to locate and remedy conditions that had been reported on the morning of the accident." Much stress is laid on the failure of the officials of the road to take proper warning from the report of the engineer who telegraphed his finding of "rough track" at the Woodlawn curve. It blames the superintendent of the Harlem division for not having warned the engineer and motorman of each succeeding train of the reported condition of the track, and expresses the further opinion that no trains should have been allowed to run over that stretch of track even at schedule time until the track supervisor of that division had reported that everything was right. No evidence was produced, the board thinks, which would justify the laying of the blame for the accident on anything but a defect in the track, "and the board assumes that there is no such evidence in existence, as the company stated at the opening of the inquiry that it would render all the assistance it could through its employees in coming to a conclusion as to the cause of the wreck." As to the responsibility of those who had charge of the adjustment of conditions to the electrification requirements, the report has no fault to find, except for the failure of the operating officials to run dummy trains for a sufficient period over all parts of the road to determine the actual working conditions of the new equipment.

COMPLAINT ABOUT LIGHTING.—The New York State Gas and Electric Commission has announced that it will investigate a complaint made by the Merchants' Association of New York City of alleged discrimination practiced by the Edison Company against the users of private lighting and power plants. A difference of opinion has existed between the company and the members of the Merchants' Association having private plants as to the obligation of the company to supply so-called "break-down service."

CHICAGO TROLLEYS.—It is stated that it will cost the Chicago City Railway $16,000,000 to carry out the rehabilitation of its lines during the next three years. This was the estimate given the company by the board of supervising engineers. It is estimated that it will cost the Union Traction Company $24,000,000 to rehabilitate the service on the North and West Sides. The board made its estimate for the South Side Company in response to the inquiry of President Thomas E. Nitten. The engineers reserved the right to call for $16,000,000 as rapidly as the progress of the work warrants. It is considered likely that improvements costing between $4,000,000 and $5,000,000 will be completed within the next year.

CENTRAL STATION EXPERIENCE.—In his campaign for new members for the National Electric Light Association, Mr. J. Robert Crouse, Jr., has compiled and circulated a number of striking testimonies for central station companies as to the great benefits they have derived from their membership in the association. Thirty letters from companies, large and small, are printed and perhaps the best evidence is that forthcoming from the small plants that have to look carefully at even so minor an expenditure as N. E. L. A. fees and dues. But there is no doubt that the companies get the outlay back many times over. It is interesting to note that attendance at the meeings is also strenuously urged by some of the writers.

NATIONAL FIRE PROTECTION.—Mr. W. H. Merrill, Jr., secretary of the National Fire Protection Association, has issued a notice to the effect that the New York offices are now established in the Engineering Societies Building, with Mr. Hugh T. Wreaks in charge. A supply of all printed matter issued by the association will be kept on hand in New York as well as Chicago, and members desiring extra copies can obtain them by addressing the association at either office. The annual meeting of the association, announced for May 22, 23, and 24, at New York, will be held in the Engineering Societies Building. Out-of-town members coming to New York for the annual meeting, or at any other time, can have mail addressed to them in care of the association, 29 West Thirty-Ninth Street.

ASSOCIATION OF MANUFACTURERS.—The annual convention of the National Association of Manufacturers in New York City is to be held at the Waldorf-Astoria Hotel, New York, May 20, 21 and 22. Already it is certain that there will be a larger attendance than at any previous meeting, and the list of speakers at the business sessions, and at the banquet, is a better one than has ever before been secured. The New York members of the association, some 500 in number, have constituted themselves an informal committee to receive and make the out-of-town members at home while in the metropolis. The chief topics to be discussed at the business meetings of the convention, and the speakers who will make the principal addresses on each topic, are as follows: Further Railroad Legislation, Hon. Charles A. Prouty, Interstate Commerce Commissioner; The Consular Service, Hon. Francis B. Loomis, formerly Assistant Secretary of State; Foreign Trade, Charles M. Pepper, special agent of the Department of Commerce and Labor; The Child Labor Problem, Dr. Charles P. Neill, Commissioner of Labor, Department of Commerce and Labor; Trade Schools, Mr. Arthur D. Dean; Needed Postal Reforms, Captain Henry A. Castle, late auditor of the treasury for the Post Office Department. Reports on these and a number of other subjects, especially interesting at this time, will be made by the committees which have them in charge.

ELECTRIC FIRES.—The fifty-fifth quarterly fire report of the Electrical Bureau of the National Board of Fire Underwriters shows that from Jan. 10 to April 10, 1907, electric fires had caused damage to the amount of $2,748,285.44. Almost half of the damage, or accurately, $1,255,467, was due to electric flat-irons, which caused a total of four fires. Almost the whole of the flat-iron damages was occasioned by a single fire, the loss from which was estimated at $1,250,000. Rheostats and controlling devices were charged with seven fires, the total loss being $50,000. The grounding of lamp and motor circuits has been responsible for 18 fires, with a total loss of $154,503. Incandescent and arc lamps were responsible for five fires, with a loss of $50,255. Thirty-four fires, at first reported as due to electricity, upon further reliable investigation were found to be due to other causes. The losses reported on the latter fires amounted to $375,617.

SLACK AND MINE-RUN COAL.—The Grinnell (Ia.) Electric & Heating Company has made comparative tests on a number of different kinds of coal available under its boilers, and as a result has abandoned the use of slack and steam coal and is using run-of-mine from certain mines found to yield the best coal. The conclusions of these tests are rather unusual in power plant practice where coal mines are within 40 miles, because, as a general thing, it has been found where coal comes from the same locality, the coal which is cheapest in price per ton is usually the cheapest to use for performing a given service. The difference in the market value of slack and lump coal usually more than makes up for the greater evaporating value of the lump, except where freight is by far the largest item in the cost of the coal. In the latter case, the conditions are likely to be reversed. It was found at Grinnell that mine-run coal would evaporate from 5.3 to 4.8 lbs. of water per pound of coal. The slack would evaporate about 3.7 lbs. of water per pound of coal. This difference alone might not have been sufficient to counteract the difference in price, but it was found that in the Grinnell plant the use of slack practically meant that one extra man must be employed in the fireroom because of the larger amount of coal and ashes that must be handled, and the greater amount of work cleaning fires. It was also necessary to run one more boiler when burning slack than when burning run-of-mine.

SHUTTING DOWN GASOLINE PLANTS.—Eight gasoline and two acetylene lighting plants have been shut down and central station service substituted at Grinnell, Ia., in a period of two years. Of the gasoline plants, five were commercial and three residential. Both acetylene plants were commercial. Some of these plants had been in so long that the owners got tired of attending to them, and the central station service had meantime been much improved both in reliability and voltage regulation. Then, too, there was an accident from one of these plants which doubtless had its influence. A pool table was set on fire by gasoline which leaked from the pipes of a gasoline lighting system, the gasoline being distributed over the premises in very small pipes. One acetylene plant was shut down on account of the increase in insurance rate. Some gasoline customers adopted central station service without solicitation. In other cases, where the merchants owning gasoline plants were solicited, it was pointed out that no progressive merchant in a large city would think of using an out-of-date system like gasoline lighting and that even if it was cheaper in operation, the public would get the impression that the merchant was one who would cling to antiquated methods rather than to adopt what is cleanest, safest and most up-to-date. It was asked whether Marshall Field & Company and similar large mercantile houses in Chicago would occupy the place they do to-day if during their history they had clung to such things as gasoline lighting and the like.

Generating Station of the Merchants Electric Light, Heat & Power Company of York, Pa.

FOR a number of years, the electric light service of York, Pa., was controlled by one company. Realizing the need of competition to prevent exorbitant rates and insure fair treatment, a number of business men organized the Merchants Electric Light, Heat & Power Company in 1900. A plant was erected in the southern part of the city, about four blocks from the center square and on the line of the Northern Central Railroad. There was no difficulty in obtaining the necessary franchises, and consequently the network of the company extends throughout the city and also to the boroughs of North York and Eberton, or West York. The principal load is made up of residence lighting and store lighting; beside public street lighting in North York and Eberton. As the stores of the city are open on Monday and Saturday nights until 10 o'clock, the heaviest loads occur on these nights.

There are many features in the design of the station which tend toward economical operation. In this case the latter is of great importance, not only on account of the short duration of heavy load due to the fact that the majority is made up of residence and store lighting; but because the company is operating in competition with the Edison Electric Light Company, a larger and older company with an established trade, and which has discarded steam engines for motors as prime movers; operating its entire plant with electricity cheaply generated by water-power, and supplied by the York Haven Water & Power Company. That the Merchants Electric Light, Heat & Power Company is successfully meeting these conditions is attested by the rapidly increasing load, making it imperative for the company to increase the capacity of its station. Although the company, has as yet, no organized business-getting department or solicitors, 55 new customers were acquired during the month of February.

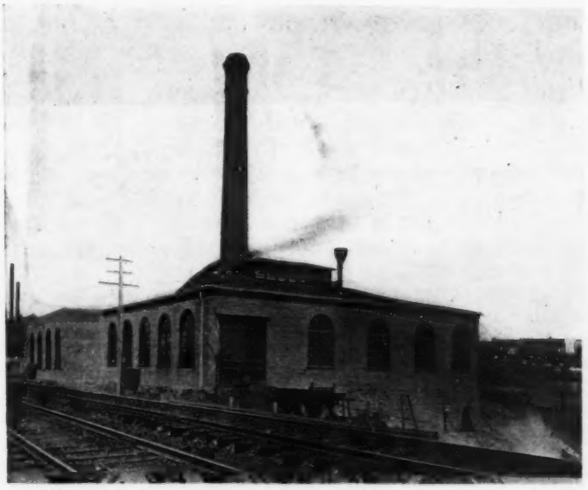


FIG. 1.—VIEW OF STATION.

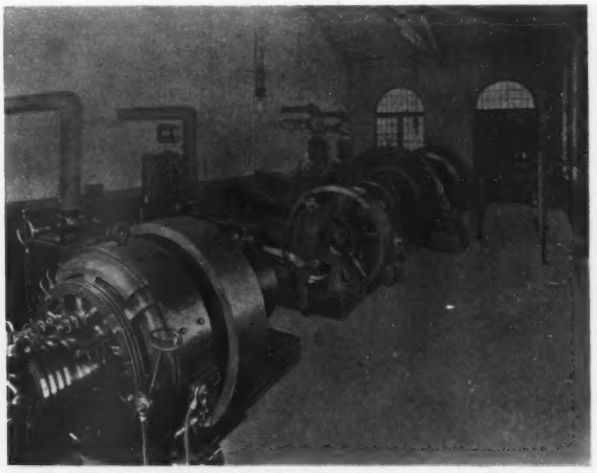


FIG. 2.—ENGINE ROOM.

The present normal capacity of the plant is 750 kilowatts, and to this will be added in a short time a 1000-kw unit. The power house is constructed of brick and concrete, and is divided into a boiler room and dynamo room by a brick partition wall. The floor of the boiler room is about 10 ft. lower than the floor of the engine room, bringing the boiler setting about level with the engine room floor. The boiler room contains a battery of six boilers built by G. F. Motter & Sons, of York, Pa.. These are of the double return tubular type and have a total capacity of 850 hp. The hot gases of combustion pass underneath the boilers to the rear; returning to the front through a portion of the tubes to a smoke box, thence back to the rear again through the remaining tubes to a breeching about four feet in diameter. The latter is placed on top of the boilers and traverses the battery, connecting with the smoke stack in the center of the boiler room. This stack is round, and is 115 ft. high. An extension has been added to the boiler room in which has been installed a 400-hp, water-tube boiler.

The engines are supplied with steam at 115 lbs. pressure from an 8-in. header which runs along the partition wall above the breeching, and is connected with each boiler through 8-in. mains and globe valves. Four 8-in. risers pass upwards a distance of about 6 ft. thence through the partition wall, and down to the engine throttles. A 12-in. exhaust line is suspended beneath the live-steam header between the boilers and separating wall, so that only a short connection is necessary from the engine cylinder to the exhaust line. The piping throughout is covered, and the arrangement is compact to such an extent that it would be difficult to improve on this feature of the installation.

From one end of the exhaust line, a heating main extends to the York Hospital; the other end of the exhaust line passing around the end of the boilers to an open feed-water heater, of sufficient capacity to supply the entire installation of boilers. Water is pumped to this heater from a small reservoir situated across Codorus Creek. One duplex feed-water pump serves the entire group of boilers, although there is a spare pump for emergency use. Originally the feed water was purchased from the York Water Company on a meter basis, and as the cost of water was rather high and complaints had no effect on the price, it was decided to sink a well; the water of Codorus Creek being unsuitable for boiler feed purposes. After using the water from this well for a short time, it was found that the boilers were corroding badly and the well had to be abandoned. The company then had some samples of water taken from different locations near the power house, analysed. It was found that the water from the well had a large percentage of calcium and other impurities; but just across the creek, possibly 200 ft. away, a good quality of water was found. A small reservoir was erected here, with coke arranged to filter the water. The result is that the company now has an abundant supply of water costing nothing except the price of pumping. The boilers are hand fired with Blaine run-of mine coal costing about $2.65 per ton. Cars enter the boiler room on a trestle directly in front of the boilers, so that coal is dumped and used without further handling. The ashes are removed by barrow and dumped outside of the boiler room.

The engine room equipment consists of two 16-in. by 18-in. Russell engines direct-connected to a C & C 125-kw, 250-volt, three-wire generator and two 21-in. by 20-in. Harrisburg engines, each direct-connected to a Westinghouse 250-kw, 2300-volt, 60-cycle, two-phase alternator. The engines are self-oiling and the rod and crank are encased. Each Harrisburg

engine has a pulley on the end of the shaft to which is belted a 22½-kw exciter. All four engines are equipped with fly-wheel governors and as the speed cannot be changed while running, the load on the alternators is adjusted by throttling the engine. The alternators are synchronized by lamps, synchronism being indicated when the lamps are dark.

The switchboard is made up of six panels. The two alternator panels are equipped with two ammeters and one indicating wattmeter; four voltmeters and two indicating wattmeters being fitted to a swinging arm. As there is but one set of bus-bars, each panel has one four-pole single-throw knife switch, ground detector plug and receptacles and a push button switch for the synchronizing lamps. The rheostat hand-wheel shafts are set one within the other, the shaft for the larger exciter rheostat being hollow. The resistance is located under the floor, wire taps being brought up to the contacts on the back of the board. There are two alternating-current feeder panels, each of which is equipped with two ammeters and a single-throw, four-pole switch. One panel controls the arc lamp circuits and the other controls the incandescent lamp and motor circuits. The feeder system is four-wire, two-phase.

There are two direct-current panels one for each direct-current generator. Each panel is equipped with two ammeters, a voltmeter, three circuit-breakers and one three-pole, single-throw switch. Each generator is connected to one three-wire feeder by its switch, there being no direct-current bus-bars in the station. Parallel operation is provided for by a three-pole knife switch which serves to tie the feeders together. This also permits one dynamo to feed both direct-current feeder circuits. No watt-hour meters are used in the station.

A temporary office is located on South George Street, adjoining which is a large supply and work room. A new office and sub-station is in course of erection on East Mason Avenue which is exceptionally well located with reference to the center of distribution. In this sub-station will be installed a 250-kw motor-generator set consisting of a 2300-volt, two-phase motor and a 250-volt, three-wire generator. The company found the cost of direct-current feeders from the main station becoming excessive; hence the sub-station. The intention is to supply all direct current from the sub-station and to generate only alternating current in the power house. The company supplies

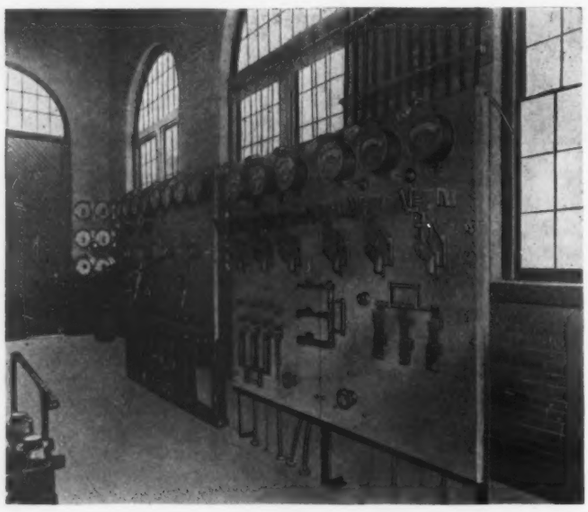


FIG. 3.—SWITCHBOARD.

28 alternating-current 6.6-ampere enclosed-arc lamps in North York and similar arc lamps in Eberton. These are all connected in multiple, it being the practice to run a small group from each transformer. The company expects to have a circuit of commercial arc lamps for store lighting shortly. Street lighting is done on an all-night schedule.

The company is about to install an extensive steam-heating system. At present the number of customers for electricity is about 1100 and during the past year the company averaged one new customer per day. The general manager of the company looks after important customers and any of the employees hearing of prospective customers reports the name and address to the office. The rate for electrical energy is 10 cents per kw-hour with a discount for prompt payment and a sliding scale for the quantity used. The rate for large quantities becomes practically 3 or 4 cents per kw-hour. The rates are the same for lamps and motors, a 24-hour motor load being no cheaper

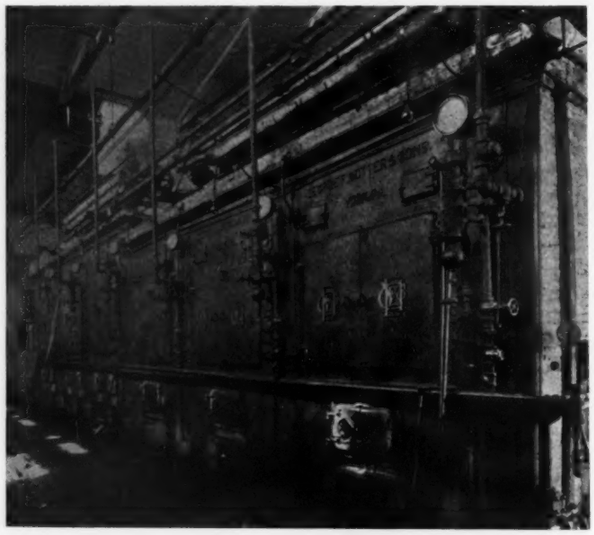


FIG. 4.—BOILER ROOM.

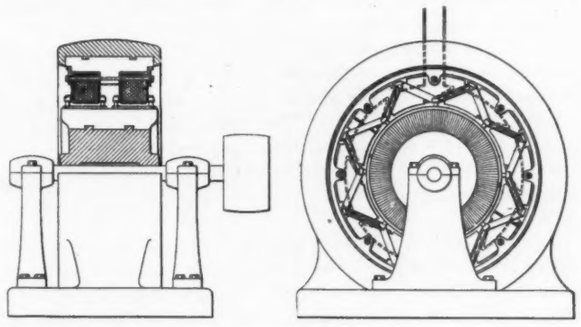
than the same number of kw-hours of energy consumed by lamps in a short time. This system obtains in the Edison plant and hence had to be used by a competing company. There are about 40 electric signs connected to the company's mains, some being equipped with nearly 200 lamps. The company pays two-thirds of the cost of the sign; the rate for energy being the same as other lighting. A small number of electric irons, sewing machine motors, etc., are in use; but no particular attention has been paid to this branch of service.

The company advertises in the daily newspapers, running a regular space which is supplemented with a large special space occasionally. Customers are accorded the most courteous treatment, regardless of the amount of energy consumed and complaints are promptly looked into. There being no heavy railway or motor load on the system to cause sudden fluctuations in voltage, the service in this respect is very good. Burned-out incandescent lamps are renewed free of charge and meters are tested on complaint. No regular meter testing department is maintained. Mr. C. H. Bear who took an active part in the organization and development of the company is the general manager and Mr. H. Rieker is the superintendent of the company.

Single-Phase Unipolar Motor.

A patent issued April 16 to Mr. Campbell Macmillan describes a form of single-phase machine possessing series motor characteristics, which does not involve the use of a commutator. The machine is of the type commonly known as "unipolar." The construction employed is illustrated in Figs. 1 and 2. The machine is in reality a transformer, portions of the secondary circuit being formed by conductors on the revolving member. Both the primary and the secondary turns surround a common ring core mounted on the stationary part. The primary winding is arranged to produce a circumferential flux around the core, and this flux induces an electromotive force in the secondary, which also surrounds the core. The secondary and primary windings are so spaced that when current flows in the

two coils a considerable leakage flux is produced, and this flux passes perpendicularly through the revolving member. The leakage flux, which passes perpendicularly to the current in the movable member, produces a torque on the rotor. The rotating armature is laminated in axial planes, and is provided with armature conductors consisting of flat plates extending around



FIGS. 1 AND 2.—SINGLE-PHASE UNIPOLAR MOTOR.

the armature, but interrupted at two or more points by pieces of insulation so as to prevent the flow of short circuit current. It is stated that the torque of the machine is proportional to the square of the impressed voltage, and that the machine possesses the characteristics of the usual series single-phase commutator motor.

A Brief Theory of the Reduction in the Service Life of Frosted Incandescent Lamps.

By Dr. A. E. Kennelly.

In the Electrical World for March 17th, 1906, Vol. XLVII. No. 11, page 567, Messrs J. R. Cravath and V. R. Lansingh published the results of a series of observations made at the Electrical Testing Laboratories of New York. The observations were made on incandescent lamps in diffusing globes. One set of clear lamps was used, each inside a holophane diffusing globe. Another set of similar lamps were made diffusing by frosting, *i. e.*, by dipping their bulbs in an acid bath. It was found that the average useful life of the clear lamps in diffusing globes was almost twice as long as that of the frosted lamps, although the initial candle-power of the frosted lamps was greater than the initial candle-power of the enclosed clear lamps. In other words, the frosted lamps fell to 80 per cent of their initial candle-power about twice as quickly as the enclosed lamps. The frosted lamps fell to 80 per cent initial candle-power in 216 hours, while the holophane-enclosed clear lamps fell to 80 per cent initial candle-power in 428 hours. No reasons for this remarkable contrast in behavior were assigned.

Mr. Preston S. Millar contributed an article on the nature and cause of this phenomenon to the Electrical World for April 20th, 1907, Vol. XLIX, No. 16, page 798. The article points out that a considerable diminution in candle-power was "due undoubtedly to the action of the increasingly dense carbon deposit in absorbing a gradually increasing proportion of the light which the frosted surface reflects and diffuses internally."

It is the object of this article to offer a simple rough quantitative theory, in conformity with the above quoted statement, and with the numerical results reported in Mr. Millar's article. It is not pretended that the brief theory here outlined is complete or rigid, but merely that it is simple and that it satisfies the numerical values reported in this case with sufficient precision for practical purposes.

The reported numerical values are briefly as follows (page 799, 20th April, 1907): A group of new clear lamps, a group of similar clear lamps burned to 88 per cent of initial cp, and a group of similar clear lamps burned to 80 per cent of initial cp, were tested for the horizontal transparencies of their bulbs, which were observed to be 0.95, 0.883 and 0.843 respectively. When these lamp-bulbs were acid frosted, their candlepowers were found to be immediately lowered in the further respective ratios of 0.94, 0.857 and 0.811. These reductions may be called the "*frost reduction-factors*" under those conditions. In commercial practice, the reduction would probably be still greater, owing to the aggregation of a dust layer on the frosted bulbs. This additional dust reduction is necessarily a variable quantity, and depends upon the conditions of service as well as upon the care taken in keeping the lamp-bulbs clean. We may, therefore, exclude the effects of dust and dirt in this inquiry, and consider only the "frost reduction factor" of a clean lamp.

For simplicity, let us suppose that the lamp filament emits 1 lumen of flux of light from a point source at the center of a spherical bulb emitting light in all directions. Let a be the transparency of the glass walls. Then the quantity of light emitted by the lamp, if the bulb is clear, will be a lumens. As the lamp continues to burn, the numerical value of a diminishes, owing to the deposit of carbon on the inside of the glass. For a new lamp, an 88 per cent lamp and an 80 per cent lamp, we may take $a = 0.95$, $a = 0.883$ and $a = 0.843$ respectively, in accordance with the data given.

If, however, the external surface of the glass is roughened by frosting, each rough glass particle acts as a secondary source of light, and throws light in all directions. The more nearly perfect the diffusion of light secured by the frosting, the more nearly complete will be the scattering of the light in every direction. In the case of complete diffusion, when the outlines of the glowing filament within the lamp become completely concealed, every particle of the surface will throw half its received light outwards into space, and throw the remaining half back into the bulb. If, however, the frosting is not so deep as to secure perfect diffusion, the outlines of the glowing filament will be indistinctly perceived, and more than half of the light reaching the external side of the bulb will be thrown off, the lesser and remaining share being thrown back into the bulb. Let this *diffusion coefficient of frosting* or *coefficient of frosting* be denoted by m. The minimum value of m, or the minimum ratio of outwardly emitted to total received light, will be 0.5 for a perfectly diffusing frosting, and the maximum possible value of m for very light frosting would be 1.0. The greater the value of m between these limits, the less the diffusion and the clearer the bulb.

With 1 lumen steadily emitted by the filament, the flux of light reaching the frosted external layer of glass on the first emergence is a lumens. At the frosted layer of coefficient m, there will be ma lumens radiated off into space and the remainder, $a(1-m)$ lumens, will be thrown back into the glass to reenter the bulb. In returning through the glass wall into the interior, this flux will be diminished by the transparency factor a and $a^2(1-m)$ lumens will reach the interior. This flux will traverse the interior of the globe in all directions and emerge for the second time to the outer frosted layer, after undergoing reduction by a, so that the flux on second emergence is $a^3(1-m)$ lumens. Here it is again subdivided, a portion $a^3m(1-m)$ lumens being radiated outwards to accompany the first stream, and the remainder $a^3(1-m)^2$ returning back into the glass, to enter the bulb and emerge for the third time as $a^5(1-m)^2$ lumens at the frost layer. Again there will be subdivision, $a^5m(1-m)^2$ radiating outwards and $a^6(1-m)^3$ returning inwards. Proceeding in this way we find the total flux of externally radiated light is

$$\phi = am + a^3m(1-m) + a^5m(1-m)^2 + a^7m(1-m)^3 + \ldots$$

$$\text{or } \phi = am\{1 + [a^2(1-m)] + [a^2(1-m)]^2 + [a^2(1-m)]^3 + \ldots$$

$$\text{or } \phi = \frac{am}{1-a^2(1-m)} \text{ lumens.} \qquad (1)$$

The total flux which would have radiated out had the bulb not been frosted, is the stream of first emergence:

$$\Phi = a \text{ lumens} \qquad (2)$$

So that the ratio of light radiated when the bulb is frosted to the light radiated when clear would be

$$\frac{\phi}{\Phi} = \frac{m}{1 - a^2\,(1-m)} \qquad (3)$$

which ratio we may call the *"frost reduction-factor."*

If $m = 0.5$ for a frosting of perfect diffusion; so that each emergence 50 per cent of the light is radiated out and 50 per cent thrown back into the glass wall, we have:

$$\frac{\phi}{\Phi} = \frac{1}{2 - a^2} \qquad (4)$$

If, on the other hand, $m = 1$, for perfect translucency, or a frosting so slight as to produce no appreciable diffusion,

$$\frac{\phi}{\Phi} = 1 \qquad (5)$$

or we return to the case of a clear bulb, with no diminution in candle-power due to frosting.

It is evident that the greatest diminution of candle-power due to frosting is with $m = 0.5$, the case of perfect diffusion, as represented by formula (4). The following Table gives the frost reduction-factor for various transparencies of glass wall, as obtained from this formula:

TABLE I.

Frost Reduction-Factors for m = 0.5 or perfect diffusion.

Transparency of bulb wall. a	Frost Reduction Factor. $\frac{1}{2-a^2}$
1.	1.
0.95	0.912
0.9	0.842
0.85	0.783
0.8	0.735
0.75	0.696
0.7	0.662
0.65	0.634
0.6	0.61
0.55	0.59
0.5	0.572

It appears from the above table that if the initial transparency of a clear globe is 0.95, corresponding to 5 per cent absorption, the frosting reduction-factor is 0.912, representing a further diminution of 8.8 per cent due to frosting and to the diffusion which is thereby produced. As the transparency diminishes, by reason of blackening of the glass wall, the frosting reduction-factor dwindles or the extra loss of light due to frosting becomes greater. In no case, however, can the reduction-factor fall below 0.5.

By reference to the data furnished in Mr. Millar's article, we obtain through formula (3) the following values of m for the three groups of lamps tested:

TABLE II.

Diffusion Coefficients as Computed from Tests.

Type of Lamps	Observed Bulb Transparency. a	Observed Frost Reduction-Factor. $\frac{m}{1-a^2\,(1-m)}$	Computed Diffusion-Coefficient. m
New	0.95	0.94	0.60
Burned to 88% i.c.p.	0.883	0.857	0.57
Burned to 80% i.c.p.	0.843	0.811	0.56

Table II shows that the diffusion-coefficient m comes out 0.6 for the new lamps, 0.57 for the 88 per cent lamps, and 0.56 for the 80 per cent lamps. Taking the middle value $m = 0.57$, we obtain the following schedule of frost reduction-factors:

TABLE III.

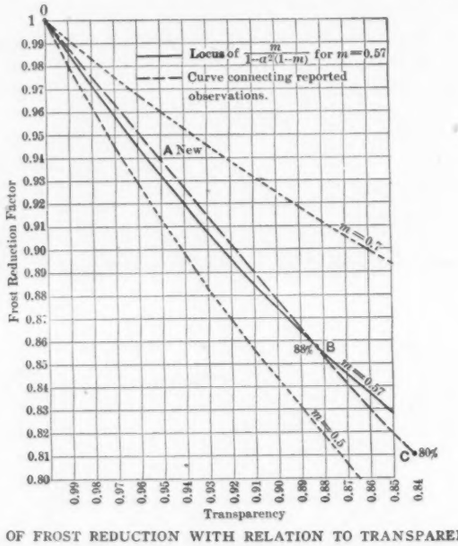
Frost Reduction-Factors for different transparencies with m = 0.57.

Transparency. a	Frost Reduction Factor. ϕ/Φ
1.0	1.0
0.95	0.932
0.9	0.874
0.85	0.828
0.8	0.786
0.75	0.752
0.7	0.713

The reduction-factors of Table III as deduced from formula (3) are represented by the heavy curves of the accompanying Figure. *A B C* are the observed reduction-factors, connected by the broken line. The Figure shows that the value of 0.57 for m satisfies the observations fairly well. The lower line of points indicates what the frost reduction-factor might be expected to be with $m = 0.5$, or perfect diffusion; while the upper line of points indicates what might be expected if the value of m were increased to 0.7, representing less diffusion, lighter frosting and greater translucency.

The Figure shows that if $m = 0.7$, the frost reduction-factor would be 0.925 for $a = 0.9$; whereas with $m = 0.57$, as observed, the factor is 0.875 for $a = 0.9$. That is, an absorption of 10 per cent in the lamp wall would be accompanied by an additional frost loss of 7.5 per cent with $m = 0.7$, whereas it is accompanied apparently by 12.5 per cent with $m = 0.57$, and a pure diffusion frosting of $m = 0.5$ would increase this frost loss to 16 per cent.

The deduction from the theory is, therefore, that the frosting of lamps should be as light as possible consistent with ease to the eye. If the lamps are unfrosted, the frosting loss is nil, but the brilliancy of the naked glowing filament is unpleasant



CURVE OF FROST REDUCTION WITH RELATION TO TRANSPARENCY.

to the eye. If we could frost to the limit $m = 0.5$ of pure diffusion, we should cease to perceive the outlines of the glowing filament, and only see the lighted bulb; but the frosting loss is 16 per cent for a transparency $a = 0.9$, or 10 per cent absorption in the walls, a condition reached after some 200 hours of burning. A compromise is to be aimed at between diffusion of light or lessened brilliancy on the one hand, and frost reduction-factor on the other.

The preceding theory, applied to the ordinary incandescent lamp, ignores a number of deviating circumstances. It can only be relied upon if checked by tests such as those above considered.

If only a portion of the lamp-bulb be frosted, the theory becomes much complicated, and involves the shape of the lamp-bulb. It is probably not worth while attempting to supply numerical corrections. If formula (3) is applied, it is to be expected that the apparent value of the diffusion-coefficient m for a zonally frosted lamp would be higher than that of a completely frosted lamp. Whether a single value of m would apply throughout a practical range of diminishing transparency can only be determined experimentally.

Film Cut-Outs.

A patent issued April 30 to Mr. Samuel Ferguson describes an interesting form of film cut-out, which is claimed not to be subjected to deterioration from moisture or other atmospheric conditions. The cut-out, as illustrated herewith, consists of an insulating cup containing mercury, the bottom of the cup

being separated from a brass retaining vessel by a sheet of paper or mica. The mercury rests directly on the paper or mica, under which there is a small depression containing a globule of mercury to insure a better contact between the main body of mercury and the brass vessel when the insulating film is

FILM CUT-OUT.

punctured. The cut-out is designed for insertion in low-potential circuits, which are so arranged that when the film is punctured by any abnormal voltage the excessive rush of current will open fuses or other protective devices in the supply circuits.

The Plotting of Speed-Time Curves.

BY A. S. LANGSDORF.

In constructing the speed-time curve of a particular motor equipment, and especially that part of it which corresponds to running without series resistance, there arises the difficulty that the known data give corresponding values of velocity and acceleration, while what is sought are corresponding values of velocity and time. That is to say, having given a number of ordinates of the speed-time curve, each with the corresponding slope of the curve at its extremity (as in Fig. 1), the problem

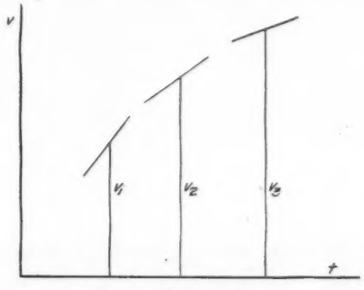


FIG. 1.—ORIGINAL DATA.

is to find the corresponding abscissas, or to properly space the vertical lines v_1, v_2, v_3, etc.

Mailloux* has offered a solution of this problem which can be made to give good results by taking a sufficiently large number of ordinates as represented in Fig. 1, but it lacks the elegance and assurance of a straight-forward method, as all methods of approximation must necessarily do. The following method, based on rigid laws of the calculus, requires no approximations whatever, and gives results quickly and easily.

From the relation

$$a = \frac{dv}{dt} \qquad (1)$$

where a = acceleration in miles per hour per second,
v = velocity in miles per hour,
t = time in seconds,

there may be written

$$a = \frac{dv}{dt}\ \frac{da}{da} \qquad (2)$$

*Notes on the Plotting of Speed-Time Curves. *Trans. A. I. E. E.*, Vol. XIX.

or

$$dt = \frac{\frac{dv}{da}}{a}\,da \qquad (3)$$

From the known data, which give simultaneous values of v and a, a curve like Fig. 2 may be plotted. By drawing a number of tangents to this curve, as indicated, values of $\frac{dv}{da}$ corresponding to various values of a may be found. Fig. 2, as

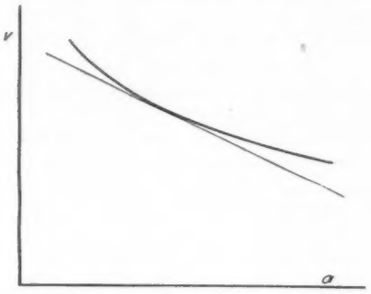


FIG. 2.—ORIGINAL DATA, VELOCITY AND ACCELERATION.

drawn, represents the shape of the (v-a) curve during acceleration without series resistance, hence $\frac{dv}{da}$ is negative, and it decreases in absolute value as a increases.

The next step in the solution is to form the quotients $\frac{\frac{dv}{da}}{a}$ and plot the latter against a, as in Fig. 3.

From equation (3)

$$\int_{t_1}^{t_2} dt = \int_{a_1}^{a_2} \frac{\frac{dv}{da}}{a}\,da = t_2 - t_1 \qquad (4)$$

Now the right-hand integral represents simply the shaded area in Fig 3, lying between values a_1 and a_2 of the acceleration;

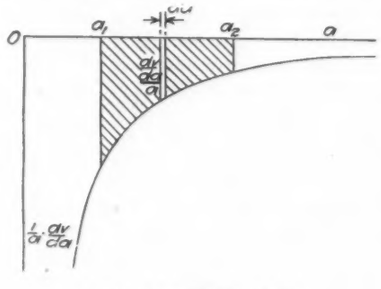


FIG. 3.—DERIVED CURVE.

hence, by equation (4), *this area is the elapsed time between velocities v_1 and v_2* (corresponding to a_1 and a_2, respectively).

This method has been tested by applying it to a particular problem, and has been found simple and reliable. To get accurate results it is necessary to plot Fig. 2 to a large scale, because the curve is in general rather flat, and hence care is necessary in drawing the tangent lines.

It is hardly necessary to add that the complete speed-time curve can be drawn in the correct position with respect to the origin only when one of the original ordinates of Fig. 1 is

located with respect to the origin; but this is usually fixed by other considerations, such as the acceleration at starting, or during the period of rheostatic control.

The Power Plant of the University of Minnesota.

By H. Cole Estep.

UNDER ordinary circumstances it is not considered good engineering to install widely different types of machinery in the same plant, yet this very condition is the most distinctive and commendable feature of the electric light and power plant of the University of Minnesota. The different types of machinery installed afford excellent opportunity for instruction and experiment in electrical and mechanical engineering, while at the same time the plant furnishes electricity for lamps and motors in the buildings of the University. This double function is evident throughout the entire installation.

The plant is of 265 kilowatts capacity and generates direct current on the three-wire system, the wires being laid in underground tunnels to the various buildings on the campus. Electricity is generated for lighting all of the University buildings, and during the daytime power is furnished to the motors in the University machine, pattern and forge shops, in the foundry, in the physical, mechanical and electrical laboratories. During the winter peak loads the demand for power is beyond the capacity of the present installation and alternating current from the Minneapolis General Electric Company is used to make up the de-

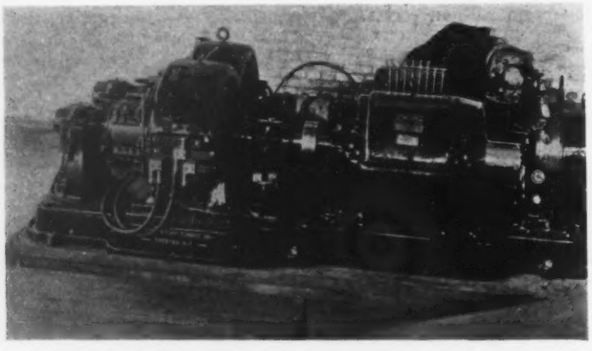


FIG. 1.—DE LAVAL TURBINE AND SPRAGUE GENERATOR.

ficiency. Power from the latter source is also used for the lighting after 9:30 p. m., at which time the University plant shuts down.

The plant is housed in a substantial 75 ft. x 100 ft. brick annex to the Electrical Laboratory. The boiler and gas-producer rooms occupy about half the floor space. The boiler room floor is 5 ft. below the street level, and the coal is dumped directly from the wagons into bins situated on this level.

Steam is generated at 100 lbs. pressure in two boilers; one rated at 100 hp is of the water-tube type, built by the Aultman & Taylor Company; the other, rated at 95 hp, is of the common return-tubular type. The feature of this return-tubular boiler is the "Dutch oven," which is an extension of the furnace built out about 3 ft. from the boiler front. It affords additional grate area and slightly improves the combustion. Natural draught is furnished by a 100-ft. brick stack, 3 ft. in diameter at the base. Provision is made for experiments on induced draught by the installation of a 108-in. induced draught fan direct connected to a small vertical engine. The feed water is heated in a Sorge-Cochrane heater, using exhaust steam. Steam is led through 5-in. mains from the boilers to an 8-in. header, from which individual mains lead to the engines and turbine.

Two reciprocating engines and one steam turbine are installed. One of the engines is a 10 x 13, 44-hp high-speed, single-valve automatic engine, built by the Alfree Engine Company, and the other is a 125-hp cross-compound, Twin City Corliss. Both of them are belted to a roller bearing jackshaft located in the basement. This shaft is divided into segments connected by friction clutches so that either engine may operate one or more of the generators. To this jackshaft are belted two 40-kw, 125-volt, three-wire generators, built by the Electric Machinery Company, of Minneapolis, and one 50-kw, 250-volt Westinghouse three-wire machine. This machine is provided with collecter rings for generating alternating current for experimental purposes. The jackshaft also operates a rope drive, which furnishes power mechanically to the electrical laboratory.

Situated adjacent to the reciprocating engines is the 150-hp

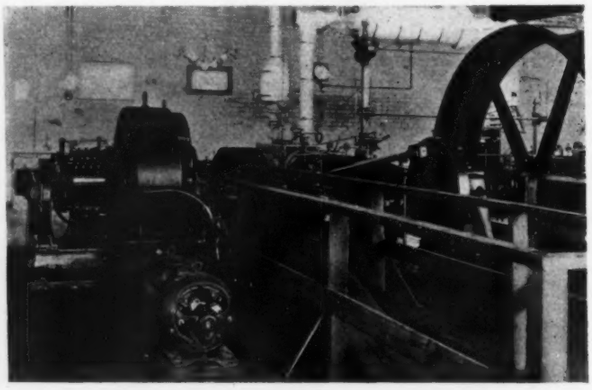


FIG. 2.—CORLISS ENGINES AND ELECTRIC GENERATORS.

De Laval steam turbine. The turbine uses steam at a pressure of 150 lbs., has five nozzles, runs at 12,000 r. p. m., and is direct connected through reducing gears to two 50-kw, 1200 r. p. m., 125-volt Sprague generators. The turbine and generators occupy a floor area 4 ft. x 10 ft. and afford a striking contrast to the bulky 125-hp Corliss engines.

The whole steam plant operates non-condensing. A superheater is being installed for use with the turbine.

The remaining unit consits of a 60-hp Munzel gas engine direct connected to a 35-kw, 220 r. p. m., 250-volt, six-pole generator, fed from a 100-hp suction gas producer using anthracite pea coal. The engine and producer were made by the Minneapolis Steel & Machinery Company, and the generator by the Electric Machinery Company. The engine is of the two-cylinder, four-stroke cycle horizontal type with the generator and flywheel between the cylinders. The ignition is by means of a low-tension magneto; the governor throttles the mixture of gas and air. The flywheel is extra heavy, and the speed regulation satisfac-

FIG. 3.—MUNZEL PRODUCER GAS ENGINE.

tory. The producer is designed to operate continuously, is provided with two scrubbers and generates its own steam. A small gasoline engine operates a fan for blowing the air used in starting the producer, and also a small pump which compresses the air used for starting the main engine.

The design of the piping between the engine and producer is particularly good. The pipes from the engine lead straight down through the engine room floor, and are then carried directly to

the producer, which being on the boiler room level 7 ft. below the engine room floor, is so situated that the connection is made with only two right-angle bends. The exhaust muffler and compressed air reservoir are also located under the engine room and the whole makes an exceptionally neat and compact arrangement.

To render the load on the plant as steady as possible a storage battery has been installed by the Electric Storage Battery Company. It consists of two sets of 55 cells, each set being provided with 20 end-cells. The battery is rated at 320 ampere-hours, normal discharge being 40 amperes for eight hours, and the maximum 160 amperes for one hour. A booster is used to raise the potential of the charging current. It consists of a 220-volt motor direct connected to two 70-volt generators.

The plant has two switchboards. One of seven panels contains the main switches, station instruments and circuit breakers. The other has six panels, two of which carry the manually-operated end-cell switches and apparatus for controlling the battery. On the four remaining panels are mounted distributing switches. These switches are of the double-throw type; the upper connections carry alternating current from the General Electric Company, while the lower ones carry current from the University plant.

According to tests made by Messrs. Rawson, Lowey and Armstrong the two boilers together evaporate 8 lbs. of water per

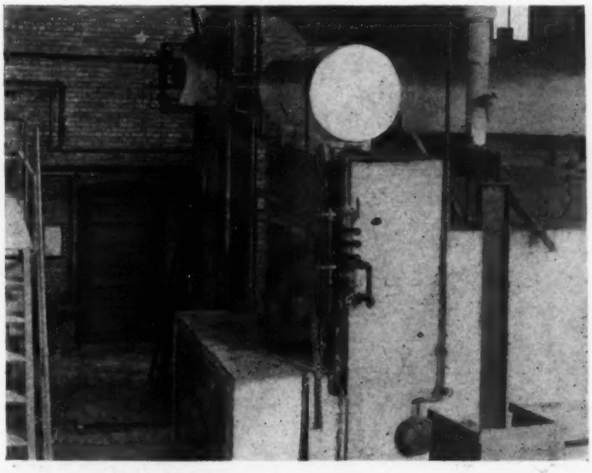


FIG. 4.—BOILER ROOM, SHOWING "DUTCH OVEN."

pound of coal; the Alfree engine, fed by the return-tubular boiler alone, uses 33 lbs. of steam per indicated hp-hour, or 5½ lbs. of coal per ihp-hour; the Corliss engine uses 28 lbs. of steam or 5.3 lbs. of coal per ihp-hour. Including labor, interest, depreciation and fuel it was found that the reciprocating engines operating under an *average* load of 25 kw for the day's run delivered energy to the bus-bars for 4.93 cents per kw-hour. The boilers burn soft coal costing $3.75 per ton, which makes the fuel cost of the Alfree engine 1.37 cents per kw-hour and that of the Corliss 1.33 cents.

The turbine uses 28 lbs. of steam per ihp-hour, so that its steam consumption is about equal to that of the Corliss. On account of the elimination of belt losses, under full load, the cost per kw-hour generated by the turbine is about 2 cents.

The gas engine consumes 1.25 lbs. of anthracite costing $5 per ton, for each hp-hour. This makes the fuel cost for the gas engine about .42 cents per kw-hour; and the total cost of the energy is about 1.7 cents per kw-hour. The economy of the gas engine is very apparent.

It is seen from the foregoing description that the plant affords an excellent opportunity for comparing the service given by reciprocating engines with that furnished by a steam turbine and a producer gas engine. Sufficient time has not yet elapsed, however, to permit of any comparisons of the relative merits of the three types of prime movers under routine service conditions, but a year's experience will undoubtedly bring out interesting data.

Mechanical Refrigeration and the Central Station.

The problems of mechanical refrigeration are of special interest to the central station organization at this season of the year, when the rapid approach of warm weather warns the consumer that it is time to make provision for the early use of artificial cooling. Probably at no other time can the central station solicitor approach the ice-using public with a better chance of securing a hearing on the question of mechanical refrigeration. Such loads are especially desirable for central stations in the summer, for in addition to being of the non-peak variety they attain their largest value at the period when the lighting equip-

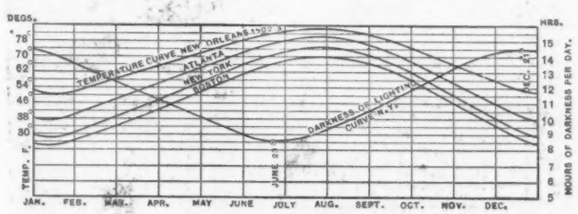


FIG. 1.—MEAN TEMPERATURE CHANGES.

ment is most underworked. Such a power requirement in many small units is therefore a most satisfactory addition to the demands upon the regular lighting and power mains.

As a refrigerating load is essentially a summer load it is always a long load in the hot months, the hours of daily operation following the weather conditions. It is a day load at any time of the year, and continuous during the hours when the cooled supplies in the refrigerating boxes are being removed and replaced by new supplies to be cooled. When used in meat markets, hotels, restaurants and by food-supply dealers, this power load comes on at a time in the early morning when other demands for electricity are very small, and becomes less at the time when the electric lighting increases, for then the refrigerators are usually closed for the day. This refrigerating load may usually be eliminated from the peak load, preferably by an automatic clock mechanism arranged to cut off the current from the compressor motor at the time of the peak, and if the apparatus is stopped but an hour or two the rise in temperature in a well-designed plant will be but a few degrees. Fig. 1 is a diagram showing the mean temperature changes during the year in different parts of the country compared to the variation

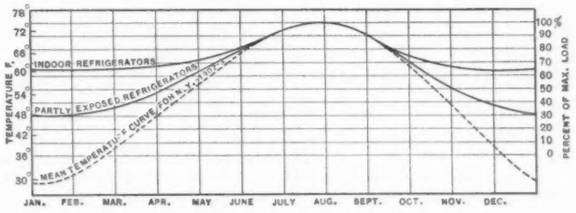

TEMPERATURE F.
PERCENT OF MAX. LOAD
INDOOR REFRIGERATORS
PARTLY EXPOSED REFRIGERATORS
MEAN TEMPERATURE CURVE FOR N.Y. CITY
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.

FIG. 2.—CURVES OF REFRIGERATING DUTY.

in the hours of darkness, the data having been obtained from weather bureau records. In the latitudes of New York and Boston a refrigerating load offsets or takes the place of a reduced and equivalent lighting load during half the year, and in the southern states, eight months.

Fig. 2 shows characteristic curves of refrigerating duty compared to the mean temperature curve for the latitude of New York. The upper curve shows the variation of duty (in cost of power or cost of ice) where the refrigerators are usually indoors, as in hotels, restaurants, cafés, etc., the minimum load or cost being about 65 per cent of the maximum, and the total yearly amount being about nine times that of the hottest month. The lower curve shows the variation of duty where the refrigerators are partly exposed to weather conditions, as in meat markets and shops for food products; the minimum load being about 30 per cent of the maximum and the total yearly amount equal to about seven times that of the hottest month. If ex-

pressed in hours of daily operation, the maximum during the hottest month would be about 18 or 20 hours per day in an average automatic plant whose operation is self-regulated by a thermostat in the refrigerating space. For indoor refrigerators this service would fall to a minimum of 65 per cent or about 12 to 14 hours per day during the winter months; and for partly exposed refrigerators the minimum will seldom fall below 30 per cent or six hours per day. It is good practice in providing for any future increase, to install a larger plant than is at first

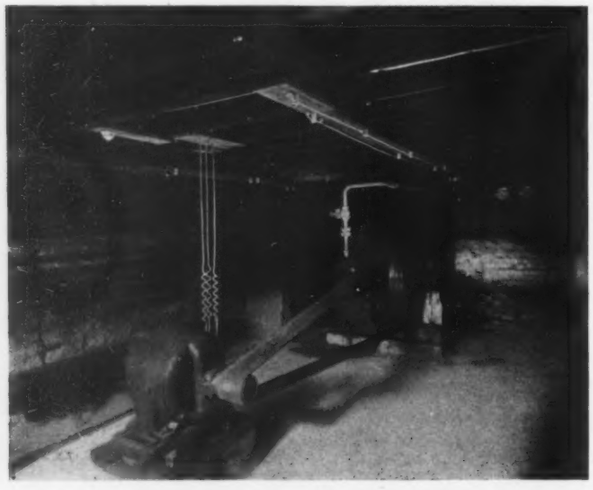


FIG. 3.—MOTOR-DRIVEN COMPRESSOR, RECEIVER AND CONDENSER.

necessary. In such cases the desired refrigeration will be produced rapidly, and the daily maximum duty may not be more than 15 or 16 hours in the hottest month, with a variation during the year as shown by the respective curves.

It is well established that electric motors furnish the best form of power for driving refrigerating apparatus because of the simplicity of their installation and ease of control. Their first cost is comparatively low and their operation certain and cheap. The only valid reason which has heretofore prevented central stations from taking up and pushing artificial refrigeration by electric power has been the lack of the necessary automatic devices to limit the operation of the equipment to the hours when it is needed—in the same way that automatic pumping outfits are now used. Non-automatic plants are limited to installations where the conditions warrant the employment of skilled attendance. This means that the field is restricted to plants of large capacities or to installations where other machinery requiring attendance is in operation. Semi-automatic apparatus may be employed in connection with other equipment or limited to daytime operation by the use of an auxiliary brine system. Automatic apparatus is best adapted to use where it is desired to maintain a constant temperature with a minimum of attendance.

In view of the relatively small power requirements of the average consumer of central-station refrigeration, the automatic system is of special interest to all new business departments. Many installations could not be operated without an absolutely prohibitive expense if regular attendance should be required to start and stop the machinery when its service was needed, or if the apparatus were allowed to operate continuously, producing an unnecessary degree of cold. During a recent test of nearly 600 hours upon an automatic system the thermostat moved so exactly as to stop a 3-hp motor-driven compressor more than 1500 times at the predetermined temperature of 36 degrees F. in a large refrigerating box, and again of itself started the equipment when the temperature had risen but 2 degrees to 38 degrees F.

Sizes of units should be selected on the basis of the smallest amount of natural ice that can be economically replaced by mechanical refrigeration on the one hand, and the smallest plant which could afford the services of a regular attendant on the other. It will usually pay to install an automatic plant where the maximum ice consumption is between 800 and 12,000 lbs. in 24 hours, provided the cost of energy is reasonable. Wherever electric energy can be furnished for motor purposes at less than 5 cents per kw-hour, automatic refrigeration effects a large saving over the cost of ice, with the additional advantages of avoiding the labor and annoyance of charging with natural ice, elimination of dampness, and ability to obtain temperatures lower than are possible with ice. The approximate power requirements for the mechanical process corresponding to different values of natural ice consumption in 24 hours are as follows:

Natural Ice Lbs. in 24 Hours.	Rating of Corresponding Mechan. Plant in H.P.
800	1.5
1,500	2
2,800	3
5,200	5
8,100	7.5
12,000	10

The following data, transcribed from the practice of the Automatic Refrigerating Company, shows the cold-storage temperatures most approved in operation:

34°—36° Fah.

Beef.	Lard.
Beer (in bbls.).	Meats (in brine).
Butter (for market).	Milk.
Canned Goods.	Mutton.
Cider.	Oysters.
Eggs.	Pork.
Fish (dried).	Veal.
Fruits.	Vegetables.
Lamb.	

40°—45° Fah.

Beer (in bottles).	Wines.

28°—30° Fah.

Cheese.	Game.
Fish (fresh).	Poultry.

18°—20° Fah.

Game (long storage).	Butter (long storage).
Poultry (long storage).	

Melting ice will chill the temperature of a refrigerating space to about 45 degrees F., unless the box be closed for a long time,

FIG. 4.—MAIN REFRIGERATOR IN BASEMENT.

when the temperature may possibly fall to 40 degrees. It cannot be further reduced without external applications of conditions hastening the rate of melting. Meats and other perishable products cannot be kept during warm weather more than a few days under these circumstances, and the dampness resulting from the use of natural ice hastens decomposition in many kinds of foodstuffs. The uniform temperature, dry air,

reduced cost of cooling, dispensing of the ice storage space and flexibility of location in an electrically operated refrigerating plant are strong points in its favor. The improved condition of the products under mechanical refrigeration led one user to state that "if some one would offer to build us an ice box and keep it filled with ice at their expense, we would not accept it in preference to our plant."

The central station solicitor is keenly interested in any figures showing the definite economy of an electrically driven refrigerating plant compared with the cost of using natural ice. Assume a 3-hp automatic plant, which in 24 hours is capable of producing refrigeration equivalent to 2800 lbs of ice. Natural ice, in a well-insulated refrigerating space of 4000 cu. ft. can maintain a minimum temperature of 45 degrees in hot weather, and will cool about 4300 lbs. of food supplies during the 24 hours. This service calls for 42 tons of ice per month, which would cost for each month in the hot season at $3 per ton, $126. The annual consumption, figured on the average requirements of the characteristic curves of refrigeration, would cost about $756.

Equivalent automatic refrigeration, in the same space and under the same conditions, would produce a temperature of 45 degrees, or the usually desired cold storage temperature of 36 degrees (in a space of about 2300 cu. ft.), cooling 4600 lbs. of food supplies per day. The consumption of electrical energy

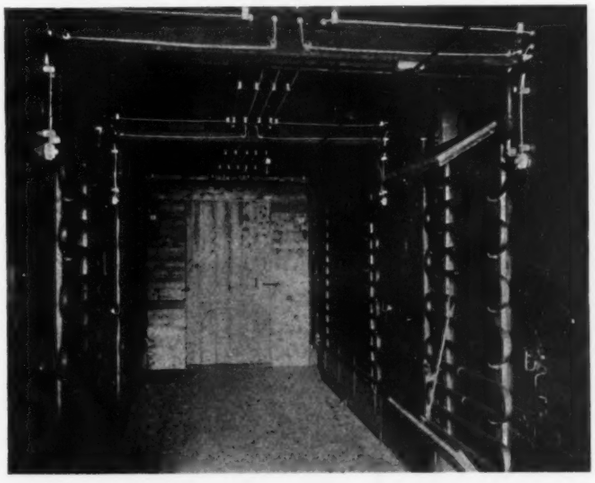


FIG. 5.—REFRIGERATING COILS IN CORRIDOR.

will be about 1646-kw hours per month if the plant is operated continuously, and at 4 cents per kw-hour will cost for each hot month about $72, including the necessary cooling water. The annual cost should not exceed $432, making a yearly saving of $324. In a very few years this saving would pay for the installation of the plant. This is an important point for the central station man to bear in mind, because the consumer often hesitates to pay the cost of a new installation through failure to realize that the saving in the long run will be so great that the cost of the plant is a mere incident in the conduct of his business.

The field of mechanical refrigeration is constantly extending and an interesting installation which illustrates the elasticity of artificial cooling by central station service is that of the large wholesale fruit firm of I. C. Sherman & Son, located at 1776 Union Street, New Bedford, Mass. In this plant, which is illustrated by the accompanying photographs, the refrigerating compartments are located on three floors of the building. The plant was laid out and installed by Mr. Eugene Carpenter, of Newton, Mass., representing the Automatic Refrigerating Company, and it consists of the standard motor-driven ammonia compressor, condenser, receiver, expansion valve, regulation and piping manufactured by that organization. The switchboard of the installation is located close by the office on the first floor, the balance of the equipment with the exception, of course, of the cooling coils being located compactly in the basement.

The chief interest of this plant is in the use made of the cooling coils. The compressor is driven by a 5-hp, 220-volt, direct-current General Electric motor supplied with power from the mains of the New Bedford Gas and Electric Company. The capacity of the plant is 2.5 tons of ice in 24 hours. The condenser is of the double-pipe type. Part of the basement is utilized as a refrigerating chamber for fruit, nuts and green produce, the temperature being kept automatically at 34 degrees F. An air lock 19 ft. long and 6 ft. wide protects the room from excessive loss of cold when the chamber is entered. The main compartment is 41 ft. long by 39 ft. wide, and around the walls are run three lines of 2-in. cooling pipe spaced 14 in. apart on centers. The room is 6 ft. 6 in. high and is electrically lighted. On the street floor is a room for the temporary storage of fruit. This is 17 ft. long, 9 ft. wide and 10 ft. high. The expansion valve of the system is located in this room.

On the upper floor is a unique arrangement of refrigerating coils. A central aisle or corridor 33 ft. long and 7 ft. wide is equipped with about 500 ft. of 1¼ in. pipe for cooling to the full capacity of the plant. On each side of this corridor are three separate rooms for the storage of bananas. Folding shutters covering air-ducts are fixed in the corridor wall of each room so that the cool air of the corridor can be admitted freely or cut away from each compartment. The capacity of the floor is about 8000 bunches of bananas, and each of the rooms is equipped with a gas heater to facilitate ripening. The demand from retail dealers varies considerably with the weather changes, and at times part of the accumulation of ripe bananas would be ruined if it were not for the possibility of keeping them at from 55 to 60 degrees F. by the refrigerating system. In case the demand slackens, the product can now be held fresh and ripe by the cooling coils, saving sometimes from 300 to 500 bunches in a single day. The arrangement of rooms enables bananas to be ripened in one compartment and held for storage in others, without interference. Normally the coils are cut off from the balance of the plant by a valve, but it is a simple matter to transfer the cooling action to the corridor when it is needed. This plant is probably the first of its kind, and already the savings made by it have been most gratifying. It marks the beginning of a widespread use of automatic electro-mechanical refrigeration in wholesale fruit houses, and deserves the inspection of any central station man happening to be in the vicinity.

Proper Selection of Steam Engines.

In a paper with the above title, read before the recent annual meeting of the Iowa Electrical Association, Mr. H. E. Chase treated the subject from the standpoint of the smaller central station.

After some general considerations he took up the case of a plant running during the night only and no heating system, with boilers more or less ancient (allowed, say, a pressure of 90 to 100 lbs.). If but one unit can be had, the medium short stroke Corliss type would, in this case, be the proper engine to buy. Under the same conditions, but with a higher boiler pressure available, it simply resolves itself into a matter of dollars and cents in the first cost, or personal preference on the part of the purchaser, whether the selection would be the simple Corliss slow-speed or the tandem-compound high-speed engine, and if the sizes are properly proportioned to the work to be done, there will be but little difference in economy of operation. Conditions all being equal the balance of difference would be in favor of the high-speed compound.

In the larger plants with engines of from 250 horse-power up, with units of size suitable for the load conditions, the superiority of some type of slow or medium speed engine is beyond question, but in the average small plant, the slow-speed engine has no place. This decision is based on the following deductions:

First, that as a prime mover the elaborate dash pot or other

accelerated cut-off devices used in the present slow-speed, drop cut-off engines are complications not warranted when comparing results.

Second, the centrally-balanced direct-acting shaft governing device serves its purpose to a much better advantage than the indirect fly-ball governor.

Third, the shorter strokes and moderately high speeds will, by reducing cylinder condensation, give better economy on light loads than the longer strokes and resultant slower speeds, and we all know the small station runs more light loaded hours than otherwise.

Fourth, the bugbear of more wear of moving parts in the high-speed machine will have a different look if we take our little note book and make comparison of the number of moving parts on the valve gear side of the modern high-speed compound as against a Corliss.

Fifth, ease of direct connection to generators, less floor space and foundations needed, resulting in very materially reducing the initial investment.

Sixth, the majority of tests of the different types show that there is a somewhat better uniformity of steam consumption under great variation of loads. In a published test made by Prof. Carpenter of Cornell University, a few years ago, it was shown that a simple Corliss rated at 120 horse-power took from 27 to 30 lbs. of steam per hp-hour when operated at a load of from 95 to 140 horse-power. The same engine operated at one-half load or about 60 horse-power required 45 lbs. steam, and from 30 to 40 horse-power the steam consumption was from 60 to 70 lbs. per hp-hour. From a number of published tests from different builders the following data have been selected as a fair representation of duty for high-speed engines:

Tandem compound non-condensing engine, using dry saturated steam at an average pressure of 125 lbs.; speed, 250 r. p. m.; cylinders 12 in. and 20 in. x 14 in.; rated at about 150 horse-power.

At ¼	load	taking	50 to 55	lbs.	steam	per	hp-hour.
" ½	"	"	35	"	"	"	"
" ¾	"	"	28	"	"	"	"
" full	"	"	25.5	"	"	"	"
" 1¼	"	"	24.8	"	"	"	"

"In order to get an idea of what the average practice has been among our brother central-station men in the selection of engines, stations in about 45 counties in the central part of Iowa, comprising the territory formerly traveled over by the writer, were taken up. These included a total of 62 towns ranging in size from 90,000 to 1800, the larger number averaging about 3000 to 3500. There are located and being operated in these towns 64 central stations furnishing electric light, heat and power to the general public, 46 of these are under private ownership and 18 are municipal plants; 6 operate hot water heating plants in connection and 8 are using direct steam for the public service heat. Among these plants the motive power is distributed as follows: Thirty simple Corliss, four compound condensing Corliss, six compound condensing high-speed, and thirty-two engines of the simple high-speed type. Numerically the high speed has a slight lead, although of course the total power would be largely in favor of the Corliss type.

"Now as to the proper selection. In going over the list we find the Corliss engine in small plants shutting down at 12 o'clock where the output at peak does not exceed 50 kw. Then again we find the simple high-speed engine in plants averaging 150 kw during 24 hours. From this showing we must naturally draw the inference that the local conditions surrounding each plant must govern to a large extent the selection of machinery. Personally the author believes that for the average plant in towns of from 3000 to 10,000, the short-stroke medium-speed, non-releasing, gear engine, with preferably the Corliss type valve, will give the best regulation, lowest steam consumption and smallest repair account at the end of a term of years."

In concluding the author said that after a good many years of close observation of all kinds of steam plants, he believes the slow-speed detachable gear machine will run longer with little or no attention than the high-speed type. Yet at the end of a term of years under practically the same conditions, the over-hauling and repairs necessary will be about the same in either case. Finally as to a plant depending on one generating unit, a comparatively small generating set will handle the load between 10 p. m. and daylight, and in some cases the fuel which could be saved by installing such an outfit would be surprising to say the least.

In the discussion, Mr. George S. Carson cited tests made on a high-speed condensing engine kept as a reserve in the Iowa city water-power plant. This 21 in. x 20 in. engine took 30 lbs. of steam per indicated hp-hour on full load. As showing the beneficial effect of having a small engine running fairly well loaded during light load hours rather than a very large unit running much underloaded, he cited the case of a plant which originally had a very large Corliss engine unit. A smaller Corliss unit was purchased at a cost of $2,500 and this was run during light-load hours. It saved $1,700 in operating expense the first year.

Mr. Austin Burt told of a four-valve engine which got in bad condition and was found to be taking 125 lbs. of steam per kw-hour. By readjustment this steam consumption was brought down to 90 lbs., but soon went back to a higher figure. Tests on a Curtis 25-kw exciter steam turbine showed a consumption of 32 lbs. of steam per hp-hour at full load and 60 lbs. at one-half load.

Mr. A. W. Zahm told of a case where by running a 250-hp unit as against a 350-hp unit the former being run overloaded most of the time the cost of energy at the switchboard was reduced 50 per cent.

Worcester Polytechnic Electrical Engineering Staff.

The following appointments have been made recently at the Worcester Polytechnic Institute.

Joseph O. Phelon, M. M. E., assistant professor of electrical engineering at the institute, to be professor of electrical engineering.

Albert S. Richey, B. M. E., assistant professor of electric railway engineering at the institute, to be professor of electric railway engineering.

George R. Olshausen, Ph. D., Department of Physics, Cornell University, to be assistant professor of theoretical electrical engineering.

Carl D. Knight, B. S., instructor in electrical engineering at the institute, to be instructor in experimental electrical engineering.

Francis J. Adams, E. E., Engineering Department, Westinghouse Elec. & Mfg. Co., to be instructor in electrical engineering.

With these appointments, the corps of instructors of the Electrical Engineering department of the Worcester Polytechnic Institute for the college year 1907-1908 will be constituted as follows:

Harold B. Smith, M. E., Director, professor of electrical engineering: Graduate from course in electrical engineering, Cornell University, M. E. degree, 1891. Resident and non-resident graduate student in electrical engineering at Cornell, 1891-1893. Adjunct professor of electrical engineering, Arkansas State University, 1892. Electrical engineer and designer, Elektron Mfg. Co., 1895. Professor of electrical engineering, Purdue University (head of department), 1895-1896. Professor of electrical engineering, Worcester Polytechnic Institute, 1896. Consulting electrical engineer, various clients, 1897.

Joseph O. Phelon, M. M. E., professor of electrical engineering: Graduate from course in mechanical engineering, Worcester Polytechnic Institute, B. S. in M. E., 1887. Graduate

student and instructor in physics, Worcester Polytechnic Institute, 1887-1889, B. S. in E. E., 1889. Instructor in physics, Worcester Polytechnic Institute, until 1896. Instructor in electrical engineering, Worcester Polytechnic Institute, 1896-1900. Sibley Fellow in electrical engineering, Cornell University, 1900-1901; M. M. E., Cornell, 1901. Assistant professor of electrical engineering, Worcester Polytechnic Institute, 1901-1907.

Albert S. Richey, B. M. E., professor of electric railway engineering: Graduate from course in electrical engineering, Purdue University, B. M. E. degree, 1894. In charge of mechanical and electrical departments Citizens' St. Ry. Co., Muncie, Ind., until 1899. Same position with Marion City Ry. Co., 1899. Chief electrician Union Traction Co., of Indiana, to 1900. Electrical engineer, Union Traction Co., of Indiana, Indiana Union Traction Co. and Indianapolis Northern Traction Co. Chief engineer of all systems consolidated under the Indiana Union Traction Co., 1905. Assistant professor of electric railway engineering, Worcester Polytechnic Institute, 1905-1907.

George R. Olshausen, Ph. D., assistant professor of theoretical electrical engineering: Graduate from course in engineering, Washington University, 1890; B. S. degree, 1890. Assistant engineer Union Depot R. R. Co., St. Louis, 1890-1891, chief engineer Union Depot R. R. Co., 1891-1894. Chemical manufacturing with C.O. Knoblauch and instructor in theoretical and practical astronomy, Washington University, 1894-1895. Chief engineer, Union Depot R. R. Co., 1895-1896. Manufacturing with Wm. Wharton, Jr., Co., Philadelphia, 1896. Advanced work in mathematics and physics, University of Berlin, 1896-1901. Ph. D. Berlin, 1901. Assistant professor of mechanical engineering, Armour Institute of Technology, 1901-1902. Professor of physics, Armour Institute, 1902. Engineer with Messrs. Lichter & Jens, on power station work, Omaha, Neb., 1902-1903. Department of physics, Cornell University, 1903-1907.

Carl D. Knight, B. S., instructor in experimental electrical engineering: Graduate from course in electrical engineering. Worcester Polytechnic Institute, B. S. degree, 1903. General Electric Co., 1903-1904. Instructor in electrical engineering at the institute 1904.

Francis J. Adams, E. E., instructor in electrical engineering: Graduate from course in electrical engineering, Worcester Polytechnic Institute, B. S. degree, 1904. Graduate assistant, electrical engineering department, Worcester Polytechnic Institute, 1904-1906. E. E. degree, 1906. Engineering department, Westinghouse Elec. & Mfg. Co., 1906. Instructor in electrical engineering at Worcester Polytechnic Institute, 1907 .

Albert T. Childs, B. S., graduate assistant in electrical engineering: Graduate from course in electrical engineering, Worcester Polytechnic Institute, B. S. degree, 1906. Experience with B. F. Sturtevant Co., and Westinghouse Elec. & Mfg. Co.

Walter D. Stearns, B. S., graduate assistant in electrical engineering: Graduate from course in electrical engineering, Worcester Polytechnic Institute, B. S. degree, 1906. Experience with the Ontario Power Co. and Westinghouse Elec. & Mfg. Co.

George R. Martin, B. S., graduate assistant in electrical engineering: Graduate from course in electrical engineering, Worcester Polytechnic Institute, B. S. degree, 1906. Experience with the Westinghouse Elec. & Mfg. Co.

Sidney W. Farnsworth, B. S., graduate assistant in electrical engineering: Graduate from course in electrical engineering, Worcester Polytechnic Institute, B. S. degree, 1906. Experience with the General Electric Co.

Award of the Actonian Prize.

The managers of the Royal Institution, London, have awarded the Actonian prize of one hundred guineas to Madame Curie, as the author of the essay, "Recherches sur les Substances Radioactives."

The Philadelphia Meeting of the American Electrochemical Society.

Following are abstracts of some of the papers and the report of part of the proceedings of the last day of the meeting of the American Electrochemical Society, held in Philadelphia, May 2, 3 and 4, which were omitted from last issue owing to lack of space.

ELECTROCHEMICAL PROCESSES AS STATION LOAD EQUALIZERS.

In a brief paper on this subject Mr. John Meyer discussed a former paper on the same subject by Mr. E. A. Sperry. He pointed out that it may be more profitable for a manufacturing concern to go to a large city even if the energy cost is somewhat higher, in view of the compensating effect of other facilities. The cost of the kw-hour should be the fundamental unit, and should be derived from actual conditions of working. The author suggested the appointment of a committee to take up this matter which is of such enormous importance both to electrochemical engineers and central station men.

The paper was discussed by Messrs. Sperry and Taylor.

CARBONS.

A paper on "Carbons in Electrometallurgy," by Mr. F. A. J. Fitzgerald and Dr. J. Forssell was the first paper on a series of experiments undertaken to determine a great many different data which are useful when carbon is employed in electrometallurgical work. The arrangement of the experiments were described in detail and shown by illustrations, and a peculiar observation was mentioned which had been made during the experiments. It was found that carbons within the furnace did show a voltage drop higher than other identical carbons in series, but outside of the furnace. The causes which might have produced this peculiarity were briefly discussed.

BOMB CALORIMETER.

A paper by Dr. Henry Noel Potter described the design of a bomb calorimeter for measuring the heat of combustion of substances giving solid oxidation products. By means of it the combustion heat of silicon was determined and found to be 7594.8 calories per gram or equivalent to 215,692 gram calories.

ABSORPTION.

A paper on energy changes accompanying "adsorption" was presented by Dr. Harrison E. Patten, of the Bureau of Soils, Washington, D. C.

The term "absorption" is used in general to designate the process by which a solid or a liquid draws unto itself and retains within its structure, or on its surface, another solid, liquid or gas. Where a solid retains another substance so that the two form a homogeneous body, the mixture is either a definite chemical compound or a solid solution.

A special case of absorption has been termed "adsorption," which may be defined as the existence of a difference in concentration or density of the film adjacent to a bounding solid, and the concentration or density of the mass of the liquid or gas which bathes this solid.

The paper was highly theoretical and quite interesting for physical chemists, but cannot be briefly abstracted. It was discussed by Prof. Bancroft.

ELECTRIC LABORATORY FURNACES.

Two papers presented by Prof. S. A. Tucker, of Columbia University, dealt with the "Construction of Electric Furnaces for Laboratory Work."

The first furnace described is a granular carbon resistance furnace which is useful for many purposes in laboratory work. The furnace is lined with magnesia brick, the electrodes are of Acheson graphite and the granular resistor is crushed gas coke, there being no particular care necessary to grade it to a certain size. However, it makes a great difference whether use is made of fresh coke as it comes from the gas retorts or coke which has served for some time as resistor. If new coke is used it will take a much higher voltage to start the run, and great care must be taken not to get too great a gas evolution during the time that the volatile matter in the coke is being eliminated.

As an example of the many uses to which such a simple furnace may be applied the author mentions that he has been able to reduce in it any oxide which can be reduced in the arc, with the great advantage that the temperature is more easily regulated and a more uniform product obtained.

The second furnace described is an electric tube furnace for temperature measurements. An agglomerated carbon tube is employed, surrounded by petroleum coke. Details are given in the papers concerning dimensions, etc.

CORROSION OF BRASS.

The society's prize of $100 for original research was awarded last year to Prof. A. T. Lincoln, of Urbana, Ill., for research on the electrolytic corrosion of brass and special bronzes. Prof. Lincoln's report was presented at the meeting. After showing Robert-Austen's diagram for all the possible phases which exist in copper zinc alloys, the author gave in numerous diagrams the results of an immense amount of laboratory work on the corrosion of the different bronzes by sodium chloride, sodium nitrate, sodium sulphate, etc. He also dealt with complex brasses and discussed the effect of the introduction of small quantities of tin into brass.

ALUMINUM AND ZINC.

In a paper on molecular and surface properties of aluminum and zinc, Mr. W. J. Hammer referred to the important effects due to the oxide film which forms on any aluminum surface in air. He pointed out how much may be learned by taking microphotographs and described tests made with drops rolling on surfaces of different inclinations.

During the Saturday session, Prof. E. F. Smith introduced the Provost of the University of Pennsylvania. Mr. Harrison spoke in a most interesting way on the connection of his family with chemical engineering in this country. He also expressed the pride which the whole University of Pennsylvania feels in the work being done there in chemistry.

During the meeting Mr. Morris described briefly the Kestner evaporator which has been very successful in Europe and which is now being introduced in this country.

The following papers were read by title although some of them were very briefly summed up either by the president or secretary. The Electrometallurgy of Zinc and its Relation to the Present Practice, by W. McA. Johnson. Moissan's Life and Work, by Dr. G. F. Kunz. Carborundum Artificial Graphite and Artificial Diamonds, by Dr. G. F. Kunz. Relative Cost of Energy, by Prof. Charles E. Lucke. This paper had been originally presented before the New York section of the American Electrochemical Society and was abstracted on page 421 of our issue for March 21. On the Density, Electrical Conductivity and Viscosity of Certain Fused Salts and Their Mixtures, by Prof. H. M. Goodwin and R. D. Mailey. Electric Reduction of Titaniferous Iron Ore, by Gustave Gin.

After adjournment of the meeting there was a demonstration of various instruments of interest for electrochemists in one of the halls. While mostly measuring instruments were exhibited, there was also a collection of fused-quartz apparatus, etc. The members and guests were then entertained at luncheon by the University in Houston Hall.

In the afternoon a visit was paid to the United States Mint where the Wohlwill process of gold refining by electrolysis has been in use for a number of years. Recently this process has been supplemented by a second process, that of Dr. D. K. Tuttle, for electrolytic silver refining. The bullion to be parted and refined is divided into two classes, by selection and by blending in making up the materials of the anodes. One class has silver as the predominant metal, but carries as much gold as will permit its treatment by electrolysis in a silver bath, by the Tuttle process, using a silver nitrate solution, with free nitric acid. The product from this operation is fine silver, and the residues consist of gold, platinum and other impurities. The other class of bullion is largely gold, selected for electrolytic treatment in a gold chloride solution, containing free hydrochloric acid, by the Wohlwill process. This method of working has proven very successful.

LETTER TO THE EDITORS.

The Lighting of Large Office Spaces.

To the Editors of Electrical World:

Sirs—The lighting of large office spaces involves mainly the question of lighting a large number of desks without shadow. Until recently the generally accepted idea in the lighting of large offices has been to provide special desk lamps at each desk and to supplement them by chandeliers or ceiling lamps for general lighting. The arc lamp has also been used to some extent for the general lighting. There can be no question that a system of low candle-power desk lamps placed at each desk can deliver a given foot-candle illumination over the top of each desk at a less cost than any system of general illumination. There are, nevertheless, some serious inherent difficulties in connection with this method of lighting, which is giving rise to a new practice, namely, that of providing sufficient general illumination of a character which will make individual desk lamps unnecessary. In order to make lighting by individual desk lamps satisfactory, especially where artificial light must be used many hours per day, it is important that each desk lamp be placed in just the right position with reference to the worker to avoid reflection or glare from the paper. This means that each desk presents a special problem, and unless the lamp is adjusted right (and it is extremely likely not to be) it will be either bad for the user of the desk or for those at neighboring desks. It is furthermore very difficult with any system of individual desk lamps to avoid entirely the injurious glare from the highly-sized papers which are now common and which is one of the things most to be avoided in artificial lighting, since it interferes with the work and ruins eyesight. Furthermore the mechanical problem of carrying cord circuits to a number of desks is considerable.

Economy may be lost, not gained, by providing a system of lighting which, although cheapest in operation interferes with the efficiency and eyesight of all the employes in a large office. The main question, therefore, is not economy in cost of light but the obtaining at minimum expense of a system of lighting which will be conducive to the best and most rapid work by the occupants of the office. Lighting costs at most are very small compared with the payroll. This leads to a consideration of methods less efficient as to energy consumed but better for the workers. With light coming from a large number of high sources and from the ceiling, there is not nearly so much annoyonce from glare from paper on desk tops, and the whole room is a more cheerful place to work in.

If a system of general lighting is to be depended upon for desk lighting as well, it is important both to avoid annoying shadows and excessive intrinsic brilliancy or glare from the sources of light. To avoid annoying shadows, it is necessary that the light shall come from a number of directions or from large light-giving surfaces. Indirect illumination by reflection from walls and ceilings is practically free from shadows, but is out of the race for the present on account of its inefficiency. Neither is it altogether pleasant to work under, according to the testimony of many who have tried it. Leaving this method out of account then, the three remaining methods which are in most prominence at the present time are (1) the use of high-efficiency incandescent lamps of 125 to 187 watts capacity, placed at frequent intervals at or near the ceiling; (2) the use of arc lamps with large diffusing globes and very large reflectors; (3) the use of vapor tube lamps. In the first system (using medium-sized incandescent units) annoying shadows are avoided owing to the number of units from which light is received on any one desk. The second system (using arc lamps) avoids shadows by reason of the globes and reflectors employed with them, which give large light-emitting surfaces, and also through reflection from walls and ceiling. The third system (using vapor tube lamps) avoids shadows by

virtue of the length of the light-giving surfaces and by reflection from walls and ceiling. It is also true with both the second and third systems that some of the avoidance of annoying shadows is due to the large number of lighting units used in a room, so that each desk receives light from several sources. The first system (using incandescent units) has been receiving an increasing amount of attention recently for various reasons, one of which is that the illuminating engineer who is looking to the future naturally figures on the substitution of tungsten or other high-efficiency lamps for those now on the market. This system of lighting will permit such substitution whenever the new lamps are ready.

Since this system has been tried in a number of prominent cases lately where thought has been given to the illuminating engineering, and is likely to find more extensive use in the future, the writer wishes to mention it in detail without in any way discrediting the merits of the other two systems, both of which have important and useful places to fill. Where a large number of incandescent units are placed at or near the ceiling at regular intervals over a large room, the principal objection that can be urged to the system is that when looking across the room the light from the large number of units must necessarily fall in the eye. To be sure, this is true of any system of direct illumination, but the fewer the units the more powerful they must be; consequently, the more uncomfortable to look at. As a matter of fact, for most desk and office work the presence of lamps at or near the ceiling does not cause much injury or discomfort for the reason that the eyebrow shades the eye of most of those who are at work. This shading effect of the eyebrow has been considerably overlooked by some and it makes fairly good many office lighting arrangements which at first glance would seem intolerable. It is nevertheless highly desirable to diffuse the light from these large incandescent units as much as possible. At the present time among the easily available appliances on the market the deep inverted bowl reflectors used with high-efficiency incandescent lamps are a step in the right direction. These bowls come down far enough over the lamp bulbs to screen them to some extent, and the frosting commonly used on the lamp tip diffuses the light coming to the eye directly from the filament in the lower part of the lamp bulb. Even this excellent arrangement, however, does not give as much diffusion or breaking up of the direct rays from a high-candle-power incandescent lamp as is desirable. It seems likely that in the future in the highest class of work the whole incandescent unit reflector and all will be placed inside of a diffusing box, hemisphere or sphere, or that combination reflecting and diffusing glassware will be used. To enclose such large units, the design of all of the standard hemispherical ceiling fixtures will have to be worked over to make them much deeper that at present, but that is an easy matter. Whatever is done, it is of great importance that greater diffusing surfaces be secured with the high-candle-power incandescent units without sacrificing the efficient distribution at all angles below 50 degrees from the vertical afforded by recent types of reflectors.

CHICAGO, ILL. JAS. K. BARRON.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Centrifugal Force.—E. SIEDEK.—In describing turbo-dynamos and high-speed motors it is usual to state the peripheral speed of the rotor. But this figure does not indicate the stress in those parts near the periphery, like the pole shoes. The peripheral speed alone does not determine the centrifugal force since the latter also depends on the number of revolutions. For instance, for one kg rotating with a peripheral speed of 80 meters per second on a circle with a radius of 0.25 meter, the centrifugal force is 2610 kg. On the other hand, if the radius is six meters, the other figures being the same, the centrifugal force is 108 kg. The author defines the centrifugal coefficient (Fliehfaktor) F as the centrifugal force of one kg on the periphery of a body revolving with uniform speed. The centrifugal coefficient is, therefore, that figure with which we have to multiply the weight of a body revolving with uniform speed in order to get the centrifugal force. If u is the number of revolutions per minute and v the peripheral speed in meters per second of the center of inertia of the rotor, then the centrifugal coefficient $F = 0.01068\ u\ v$. The centrifugal force equals F multiplied by the weight in kg. For first approximation the formula $F = 0.10\ u\ v$ may be used, the error being about 7 per cent.—*Elek. Zeit.*, April 25.

Direct-Current Windings.—N. GENNIMATAS.—A note supplementary to his recent article on the direct determination of the number of elementary groups between two adjoining commutator segments of a direct-current winding closed on itself.—*Elek. u. Masch.*, April 21.

Single-Phase Motors.—J. BETHENOD.—A continuation of his article giving theoretical notes on the compensated single-phase shunt motor.—*L'Eclairage Elec.*, April 27.

Lamps and Lighting.

Arc Lamps for Photography.—A note on a method of A. Kufferrath for impregnating carbons, which gives to the light from an arc lamp all the special properties required in photographic work. This is done by impregnating the carbons with a 1-per-cent solution of an equal mixture of yttrium and lead nitrates. Carbons thus treated are not distinguishable from ordinary kinds as regards luminosity and power consumption, but they have a fairly large actinic power. They burn without forming any residue and their light is particularly rich in violet rays.—Lond. *Elec.*, April 26.

Electric Train Lighting.—An illustrated article on progress of electric train lighting in Germany. On several of the German express trains electric lighting is used in addition to gas lighting, one single dynamo and one battery supplying the whole train. On most of the other railroads every car is provided with a small dynamo and battery. The Rosenberg dynamo (which has been described at length in the Digest) is employed. Iron-wire resistances are used in series with the lamps. On the Danish railroads 48-volt tantalum lamps and on the Saxonian railroads 32-volt zirconium lamps have been used during the last year, and it seems that they have proven satisfactory.—*Elek. Zeit.*, April 25.

Power.

Electric Power in Slate Mining.—M. KELLOW.—An abstract of a paper read before the (British) Institution of Civil Engineers. He recommends the development of the water powers which are abundant in the neighborhood of slate mines. In discussing the advantages and disadvantages of direct and alternating current, he decides in favor of the three-phase alternating-current system with a frequency of from 40 to 50 cycles. The conditions prevailing in slate mills are favorable to group driving by moderate-sized squirrel-cage induction motors.—Lond. *Elec.*, April 19.

Hydro-Electric Station.—R. FRILLEY.—A detailed and fully illustrated description of the hydro-electric plant at Saint Cezaire on the Siagne River. This plant of 8000 horse-power has just been opened for the principal purpose of furnishing energy to the district of Marseille. At present four generating sets have been installed, each of 1500 kilovolt amperes and producing three-phase currents at 10,500 volts at 25 periods. There are seven transmission lines, two transmitting three-phase currents at 30,000 volts, two transmitting three-phase currents at 10,000 volts, and three transmitting single-phase currents at 10,000 volts.—*L'Eclairage Elec.*, April 27.

Traction.

Electric Traction on Italian State Railways.—W. KRÜGER.—

The Congress of Italy has recently granted $182,000,000 for Italian state railways. Of this sum $10,000,000 will be spent for introducing electric traction on the following sections of main railways:

1.	Pontedecimo-Busalla	Length	about	11 km
2.	Savona-S. Giuseppe	"	"	21 "
3.	Bardonecchia-Modane	"	"	7 "
4.	Mailand-Monza-Lecco	"	"	51 "
5.	Usmate-Bergamo	"	"	26 "
6.	Calolzio-Ponte San Pietro	"	"	18 "
7.	Gallarate-Arona	"	"	26 "
8.	Gallarate-Laveno	"	"	32 "
9.	Domodossola-Iselle	"	"	19 "
10.	Pistoia-Porretta	"	"	40 "
11.	Neapel-Torre Annunziata-Salerno	"	"	54 "
12.	Torre Annunziata-Castellammare	"	"	0 "

The total length of these 12 lines is 311 kilometers. The lines 7 and 8 which branch off from the Milan-Portoceresio Railway will be equipped with a system similar to the one in use on the latter, namely, direct current with third rail. On the other hand, the lines 4, 5 and 6 which connect with the Veltellina Road and line 9 which connects with the Simplon Tunnel will be equipped with the three-phase system. The three-phase system will also be employed on line 1 and probably on lines 2, 3 and 10, and it seems that at present the engineers of Italian railways prefer the three-phase system. On the other hand, it is not impossible that the single-phase system will be used on the lines 11 and 12.—*Elek. Kraftb. u. Bahnen,* April 13.

Single-Phase Railroads.—A list of single-phase railroads built by the Siemens-Schuckert Company and equipped with compensated series motors:

	Motor Cars.	Locomotives.	Number of Motors.	Total Hp.
Murnau-Oberammergau	4	—	8, each of 100 hp...	800
"	—	1*	2, each of 100 hp...	200
Swedish State Railroads	—	1	3, each of 110 hp (voltage up to 20,000)	330
Vienna-Baden	14	—	for d. c. and a. c. 56, each of 40 hp...	2240
Blankenese-Ohlsdorf (Near Hamburg.)	6	—	12, each of 125 hp..	1500
Rotterdam-Haag-Scheveningen. (Speed up to 75 kilometers per hour.)	20	—	40, each of 175 hp.. (10,000 volts.)	7000
Parma	10	—	20, each of 60 hp	
Midland Railway	8	—	8, each of 60 hp....	1680
Oranienburg Experimental Road	2	—	4, each of 175 hp...	700
Seebach-Wettingen	—	1	2, each of 175 hp...	350
Civita-Roma-Castellana	4	—	6, each of 225 hp...	1350
			16, each of 40 hp..	640

*For freight trains.

The total rating of the single-phase motors of these railroads is therefore 1679 horse-power.—Supplement to *Elek. Zeit.,* April 25.

Proposed Single-Phase Traction in Berlin.—W. Reichel.—The first part of a paper on the proposed introduction of electric traction on the Berlin city and suburban railroads. The chief conclusions of the paper have already been noticed in the Digest. In the present installment the author gives an outline of the increase of traffic and emphasizes the necessity of introducing electric operation, describing its conveniences and commercial advantages. He then passes over to the discussion of the different systems which would be possible in electric operation. The third-rail direct-current system is first discussed. The article is to be continued.—*Elek. Kraftbetr. u. Bahnen,* April 13.

Electric Mountain Railroad in Switzerland.—S. Herzog.—The first part of an illustrated description of the Arth-Rigi railroad. It is built in two sections, one in the valley from Arth to Goldau and the second being the mountain section connecting Goldau with Rigikulm. The power station is located at Goldau and obtains from another electricity plant three-phase currents at 8000 volts and 50 periods. The voltage is reduced in a transformer and the current then converted into direct-current in a motor-generator. The 200-kw dynamo of this set furnishes direct current at from 800 to 1100 volts when running at 420 r. p. m. It is supplied with commutation poles for the purpose of allowing the brushes to remain fixed for all voltages and all loads. The article is to be continued.—*Elek. Kraftb. u. Bahnen,* April 13.

Electric Freight Railway.—Schauer.—An illustrated description of an electric freight railway, south of Dresden in Germany, for the object of connecting an industrial district with a steam railway. Each locomotive used has two axles and two 35-hp 550-volt direct-current motors, with series-parallel control. Each locomotive can haul a train of 85 tons total weight on a level track at a speed of 10 km per hour.—*Elek. Kraftb. u. Bahnen,* April 4.

Automobiles.—A second article on Cordingly's motor show describing a Belgian gasoline-electric system in which accumulators are used, and several electric automobiles and their methods of speed control.—Lond. *Elec.,* April 19.

Railway Signaling.—T. H. Patenall.—In a continuation of the serial on railway signaling, the development of the electric train staff system is outlined.—*Electric Jour.,* May.

Installations, Systems and Appliances.

Statistics of Central Stations in Germany.—For the twelfth time the annual statistical tables of central stations in Germany are published. The figures given relate to April 1, 1906. Only real central stations are included, all isolated stations being omitted. On 60 full pages tables are given, containing an immense amount of information on the systems used, the equipment of the stations, the ratings of charging, the capitalization, etc. There are now in operation 1338 plants, against 1175 last year. During the last year 163 new stations were opened, against 147 in the preceding year. Concerning these figures it should be stated that all stations which belong to one company, if they supply one and the same city or district or if they are located in the same city, are counted as one single plant. Thus all the stations belonging to the Berlin Electricity Works located in Berlin and suburbs are counted as one station. The reason is that their net works are either directly or indirectly interconnected. On the other hand, in cities like Hamburg, where there are several stations which are neither electrically connected nor financially affiliated, these stations are counted independently. After the section giving the statistics for these works in operation there follows the statistics for the works in course of construction. Their number is 368, against 540 in last year's statistics. Of these 368 stations, 59 have been opened in the meanwhile (*i. e.,* since April, 1906). It is stated that there are about 200 more stations, for which, however, no statistical data are available. An alphabetical index of these cities is given. If these stations are also counted, the total number of stations at present in operation in Germany is about 1600. Of the stations 53 have an output of more than 200 kilowatts. These 53 stations are located in 50 cities and their aggregate output is 414,500 kilowatts. The largest station is the Berlin Electricity Works (direct-current and three-phase currents) with a total rating (machines and storage batteries) of 108,956 kilowatts. The next is the Hamburg Electricity Works (direct-current) with 26,872 kilowatts; the third is the Rheinfelden plant which utilizes the Falls of the River Rhine and produces three-phase currents and direct-current, the total rating being 14,494 kilowatts. From the summarizing statistical tables, we reproduce the following. Table I gives information on the different systems used and their capacities.

TABLE I.

System.	Number of stations.	Rating in kw Machines.	Rating in kw Accumulators.	Total rating in kw
Direct current	1080	183,810	69,334	253,144
Single-phase and two-phase currents	37	23,977	115	24,092
Three-phase currents	96	129,585	2,331	131,916
Monocyclic system	2	1,505	152	1,657
Combined direct and single-phase or direct and two-phase currents.	18	23,636	2,540	26,176
Combined direct and three-phase currents	100	233,724	39,064	272,788
Combined direct, single-phase and three-phase currents	1	13,278	38	13,316
Total	1338	609,515	113,574	723,089

Concerning the net works it is stated that underground cables are used by 98 stations, overhead wires by 604 stations and both cables and overhead wires by 248 stations. For the balance, or 388 stations, the system is not known. Table II gives the type of prime movers used in the stations.

Of the stations 539 are rated between 0 and 100 kilowatts, 565 stations between 101 and 500 kilowatts, 92 stations between 501 and 1000 kilowatts, 55 stations between 1001 and 2000 kilowatts,

32 stations between 2001 and 5000 kilowatts and 21 stations above 5000 kilowatts, while for the balance of 34 stations the rating is not known. Finally, Table III gives the connections of lamps and motors. In this table the number of incandescent lamps is not the real number of lamps installed, but their equivalent in

TABLE II.

Prime movers.	Number of works.	Total rating of machines in kw
Steam	616	317,430
Water	135	14,683
Wind	1	220
Gas	170	20,226
Diesel engines	9	1,059
Gasoline	1	5
Electricity bought in bulk	9	1,015
Water and steam	250	96,260
Water and gas or other internal combustion engines	67	4,702
Steam and gas or other internal combustion engines	40	12,704
Miscellaneous, like water, steam and gas, etc.	40	141,211
Total	1,338	600,515

50-watt lamps. In the same way the figure for the arc lamps represents the equivalent in 10-ampere 550-watt arc lamps. The incandescent lamps include carbon lamps, Nernst lamps and metallic filament lamps.

TABLE III.

	Number.	hp	kw
50-watt incandescent lamps	8,238,896	——	411,945
10-amp. arc lamps	154,901	——	77,451
Electric motors	——	377,755	339,376
Total for lamps, kw	489,396		828,772
Total for motors, kw	339,376		

A table and a diagram show the development of electric central stations in Germany from 1894 to 1906. The curves are quite regular. They show a constant increase in capacity from year to year, the yearly rate of increase of capacity being about constant from 1894 to about 1898. Then the rate of increase becomes greater, but is again constant to about 1905. The last year it is again increased. The rate of increase of the number of stations was largest before 1900 and is now very slightly smaller.—*Elek. Zeit.*, April 18.

Wires, Wiring and Conduits.

Wiring Rules.—An editorial on the new (fifth) edition of the wiring rules of the (British) Institution of Electrical Engineers for pressures up to 250 volts. Several of the changes made against former editions are discussed. One of the most important appears to be the test specified for cables with rubber dielectrics. According to the old rules, the test piece of insulated cable was immersed in water for 24 hours, and, while still immersed, was subjected to a pressure of 2000 volts between the conductor and water for 10 minutes, and prior to immersion the test piece was bent six times (three times in either direction) round a smooth cylindrical surface having a diameter not more than 12 times that of the finished cable. This test has now been revised by omitting the bending part of the test and by increasing the duration of the pressure test to half an hour, the frequency to be 50, and the e. m. f. curve to be as nearly as possible to a sine wave. In the case of flexibles, these, according to the old rules, were to be tested by twisting two sample lengths together, and applying for 10 minutes a pressure of 1000 volts alternating at a frequency of from 40 to 100 between the sample lengths, at the same time subjecting them to the vapor arising from a pan of boiling water placed in position 10 minutes before the beginning of the test. The boiling water has now been dispensed with, and the test varies according to the nature of the insulation. If of pure rubber, the flexible is tested for 15 minutes with a pressure of 1500 volts alternating between the conductors at a frequency of 50. But if vulcanized rubber is used for the insulation then the same test is applied after the flexible has been immersed for 24 hours in water, and while still immersed.—Lond. *Elec.*, April 19. Long abstracts of the rules are given in Lond. *Elec.* April 26 and in Lond. *Elec. Eng'ing*, April 18.

Flexible Conductors.—A. SCHWARTZ.—The first parts of an illustrated paper read before the (British) Institution of Electrical Engineers in which the author first deals with the causes of deterioration in flexible conductors. He then considers the method of insulating them, and describes in detail the properties of rubber. He also deals with the various mechanical and electrical tests to which flexible cables should be subjected, and concludes by describing various systems of surface wiring using flexibles, which have been more particularly adopted in Continental Europe.—Lond. *Elec.*, April 19 and 26.

Resistivity Temperature Formula for Copper.—E. JASSE.—A communication with reference to the recent article by Prof. F. B. Crocker, ELECTRICAL WORLD, Feb. 23, 1907. Emde has given an easy way to obtain the temperature coefficient a_t in the formula $R_t + \Theta = R\ (1 + a_t \Theta)$ for any initial temperature. This formula is graphically represented by the straight line in Fig. 1 where the resistivity is plotted against temperature. Now, if

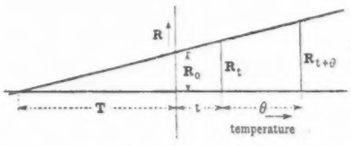


FIG. 1.—RESISTIVITY TEMPERATURE CURVE.

the distance between zero temperature and the point where the curve meets the abscissa axis be called T, it can be easily seen from the diagram that the coefficient a_t based on an initial temperature t is equal to $\frac{1}{T+t}$ *i. e.*, the reciprocal value of the temperature t increased by the constant T. Assuming the correct value of the coefficient for 0 degree C. to be 0.0042, then the value of T would be 238 degrees C. Such a figure can easily be remembered, and if using a slide rule it requires only a slight motion to get the coefficient for a given initial temperature. The coefficient 0.004, which has been adopted by the Verband Deutscher Elektrotechniker in the German rules, refers to 15 degrees. If this coefficient were reduced to 0 degree C. initial temperature it would be 0.004255 (corresponding with a value of $T = 235$ degrees C.), which figure differs from the American figure by only one-third per cent for 100 degrees C.—Lond. *Elec.*, April 19.

Fuses.—J. G. MEYER.—The first part of a paper read before the Berlin Electrical Society giving theoretical and practical notes on fuses. The author distinguishes two periods of the operation of a fuse; the first period is that in which the fuse is heated up to the melting point. The second period is from the moment when the melting point is reached to that when the circuit is broken. The author gives formulas for the calculation of fuses and has also determined constants for use in these formulas. The paper is to be concluded.—*Elek. Zeit.*, April 25.

Electrophysics and Magnetism.

Formulas for Hysteresis Curve.—E. MÜLLENDORFF.—The author gives empirical formulas for the hysteresis curve. The first is as follows:

$$B = B_0 \sin\ (\rho - a \cos \rho)$$

where B is the number of the induced lines of flux per square centimeter cross-section, B_0 is the maximum value of B, and a is a constant. This formula is valid only for magnetite ore and for some kinds of cast iron. To reproduce the results for all kinds of iron a small correction is necessary and the formula becomes:

$$B = B_0 \frac{\sin\ (\rho - a_1 \cos \rho)}{\cos\ (a_2 \cos \rho)}$$

A similar agreement might be obtained by means of the formula

$$B = B_0 \sin^n\ (\rho - a \cos \rho)$$

The author gives some further modifications.—*Elek. Zeit.*, April 18.

Conductivity for Heat and for Electricity.—J. KOENIGSBERGER.—A paper on those cases in which discrepancies have been observed from the law of Wiedemann and Franz on the proportionality between electric conductivity and thermal conductivity. The author shows that these discrepancies can be suffi-

ciently explained without necessitating the assumption of the existence of more than one kind of electrons.—*Phys. Zeit.*, April 15.

Coherence.—P. Jegon.—A note on the theory of coherence, the chief feature of which is that the effect is considered to be the result of an increase of pressure.—*L'Eclairage Elec.*, April 20.

Electrochemistry and Batteries.

Electrolytic Bleaching Solutions for Paper Pulp.—W. P. Digby.—An article giving results of tests in commercial practice with paper-pulp electrolytic hypochlorite solutions. The chief elements which must be taken into account are pointed out and the results of tests are given in diagrams and tables. The investigations which the present writer has conducted both in the laboratory and in large scale experiments, lead him to believe very strongly in the possibilities of electrolytic hypochlorite processes for paper and textile bleaching. It is necessary for effective bleaching that the initial strength of available chlorine within the potcher should not be less than 350 grains per cubic foot, and it does not at present seem necessary that this value should exceed 500 grains. The intensity of the whiteness attained depends largely upon this initial strength and upon the material not being too fluid in its nature. With pulp free from too much moisture, solutions containing from 3.0 to 4.0 grammes of available chlorine per liter can be produced at a high electrochemical efficiency. The electrolytic solutions act with greater rapidity, and the degree of heating need not be pushed very far. Above all, there remains the fact that one atom of chlorine in the sodium hypochlorite molecule in the electrolytic solution is more potent than one atom of chlorine in the calcium hypochlorite molecule of a chloride of lime solution. In the case to which the present figures refer this margin was found to be 1.5 to 1.0. In the case of another mill, the writer estimated it at 1.65 to 1.0, and a consulting chemist, to whom the mill owners referred the question, reported from his laboratory tests that the figure was nearly 2.0 to 1.0.—*Electrochem. and Met. Ind.*, May.

Alkali Chloride Electrolysis.—O. Steiner.—An article on the theory and practice of the Aussig "Glocken-process" for alkali-chloride electrolysis (or, as it is sometimes called in this country, the bell process or the gravity process). The author does not agree with the usual explanation which assumes that the fresh electrolyte introduced into the anode department moves downwards with the same speed with which the O H ions move upwards. This would naturally prevent the O H ions from reaching the anode and starting troublesome reactions, but the author shows that the necessary conditions for this cannot be fulfilled in practice. The reason why no O H ions go to the anode must rather be found in the fact that a solution saturated in NaCl or KCl is constantly supplied to the anode compartment and carefully distributed all over its surface. Under these circumstances Cl ions are the only negative ions moving in the immediate neighborhood of the anode. The chief condition which must be fulfilled is that the anode fills out almost the complete cross-section of the cell, that it is perfectly flat and is held strictly in a horizontal position.—*Electrochem. and Met. Ind.*, May.

Electrolysis.—G. Rosset.—The conclusion of his experimental investigation on the electrolysis of solutions. In this installment the author discusses the electrolysis of a lead acetate solution and gives curves for the relation between applied voltage and current density showing the well known bending point. He then discusses the allotropic state, the general influence of concentration on electrolysis and the influence of the densities between electrodes.—*L'Eclairage Elec.*, April 13.

Units, Measurements and Instruments.

Cable Tests With Telephone Currents.—B. Gati.—In recent years methods for measuring telephone currents have been devised by Kennelly and Duddell. They use mirror instruments. The present author has succeeded in improving several details of the methods. For instance, by a better adjustment of the resistance measurements, by the use of a stronger measuring current, of a smaller galvanometer resistance, gold-wollaston wire instead of platinum, he has improved the barretter method of Kennelly so that telephone currents can be measured with needle galvanometers. The resonance curve is reproduced which was obtained with a microphone before which an electrically-driven tuning fork was operated. The transformed telephone current was measured. The resonance is clearly shown, and on this account the method is well adapted for capacity measurements. The curve is first plotted with the use of a known capacity C in Fig. 2 in which A is a source of current. If an unknown capacity is then connected in parallel with C, the barretter galvanometer gives a certain reading, and from the current corresponding to this reading, the corresponding capacity is found from the curve. Capacities of cables determined with direct current do not agree accurately with the values found by alternating current. Values found by telephone frequencies are smaller. Decisive conclusions can only be made after more extended tests which are now in progress. To improve the transmission of telephone messages over very long distances the author makes the following proposition based on the fact that the currents of higher frequency are more damped than the currents at lower frequency. The distortion of the speech would, therefore, be diminished if the microphones would be built in such a way as to give relatively stronger currents for higher frequencies than for lower frequencies, and the author claims that this is possible.—*Elek. Zeit.*, April 18.

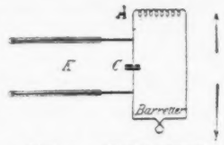


FIG. 2.—CABLE TESTS.

Inductance Measurements.—H. B. Taylor.—The function of a secohmmeter is to increase the sensibility of bridge measurements of capacity and inductance by continual quick repetition of the impulses received by the galvanometer due to the discharge of the condenser or of the magnetic field as the case may be. The secohmmeter consists of two rotating commutators, each having two contact pieces and four brushes. One commutator reverses the connection between the bridge and battery and the other reverses the connection between bridge and galvanometer at the proper instant to keep the impulse received by the galvanometer due to the discharge current always in the same direction. The author describes a convenient and cheap device to take the place of the rotating secohmmeter in comparing coefficients of self induction, though it is not suitable for capacity measurements. Relays of the kind used on telephone switchboards can be connected as double-pole, double-throw reversing switches and will operate well at speeds as high as 120 reversals per second. Telephone relays are made with different numbers of contacts. For this purpose six connections are required, two of them being the metal strips which can be made to vibrate at the outer end between two fixed contacts on each side of them. Normally the middle tongues make connections with one pair of fixed contacts. If direct current is applied to the relay magnet its armature is attracted and transfers the contact to the other pair. On alternating current at frequencies of 60 cycles and lower

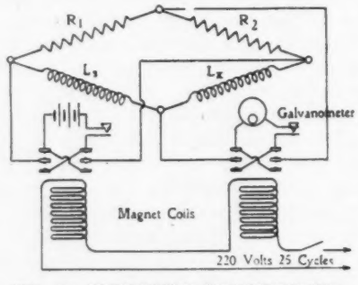


FIG. 3.—INDUCTANCE MEASUREMENTS.

the armature responds to the reversals of line e. m. f., changing the connection twice during each cycle. Direct current with an interrupter in the circuit can be used when alternating current is not available. A pair of such relays has been used extensively with a bridge and standard inductances, connected as shown in Fig. 3. High sensibility has been obtained at all times and the arrangement is more convenient than a sechommeter in several ways. All that is necessary to set the relays in motion or stop them is to close or open a key switch. The noise is somewhat objectionable, but since they can be started or stopped instantaneously, it is never necessary to keep them connected very long at a time.—*Electric Jour.*, May.

Telegraphy, Telephony and Signals.

Telephone Exchange.—A. E. LAIDLAW.—An illustrated description of the new Paddington telephone exchange in London. It is a central battery exchange and replaces the old magneto exchange. A modification has been made in the in-coming order-wire junction circuits by means of which the junction operator cannot ring the wanted subscriber if the originating operator has failed to make the connection to the junction assigned to the cell. Another addition is the provision of indicators on the four-party-line ringing keys, so that if an operator has to ring a subscriber a second time, the indicator informs her which key was last depressed. In the design of the switchboard frame, a new fire-proof construction has been adopted, and details are also given in the article of the arrangement of the arrester and fuses on the main distributing frame, and the type of cell adopted for the central battery.—Lond. *Elec. Eng'ing*, April 25.

Telephone Cable.—O. HINTERMAYR.—An illustrated description of the telephone cable laid in the Kings Lake (Königssee) in the upper Bavarian Mountains. The insulation resistance is 1400 megohms for one km. The circuit resistance is 31.9 ohms per km.—*Elek. Zeit.*, April 25.

Miscellaneous.

German Association of Electrical Engineers.—The annual meeting is to be held in Hamburg. The committee on safety rules has prepared a long set of regulations for electric installations with wiring rules, etc., which are reprinted in full and discussed editorially. The committee on the standardizing of machinery has proposed several amendments to the old standardizing rules. Among them is the rule that the capacity by which all machines and transformers are to be rated is the power furnished by the machine. It is to be given for direct current in kilowatts and for alternating current in kilovolt amperes, and the lowest permissible power factor is to be stated. If mechanical power is furnished it is stated in horse-power. On the name-plate there are to be stated the capacity, the normal speed, frequency, voltage and amperage and for induction motors also the starting voltage at the slip rings. Among the 14 papers announced, there are five on single-phase motors or single-phase traction.—*Elek. Zeit.*, April 25.

Westinghouse Company.—A brief history, by E. H. Sniffen, of the Westinghouse Machine Company and its principal achievements; and an outline, by H. D. Shute, of the engineering course of the Westinghouse Electric & Manufacturing Company.—*Electric Jour.*, May.

High-Speed Tool Steels.—G. R. NORRIS.—An outline of the evolution of high-speed tool steels in recent years. The article is based chiefly on the recent paper of F. W. Taylor before the American Society of Mechanical Engineers.—*Electrical Jour.*, May.

BOOK REVIEWS.

LES TELEGRAPHES EN EUROPE. By E. Guarini. Paris: H. Dunod. 68 pages, 22 illustrations. Price, 5 francs.

The author of this pamphlet is a professor of physics and also of applied physics at Lima, Peru. The data he sets forth have been compiled from official sources among the various European governments. The compilation is in a convenient form for comparative reference. It shows that the Morse system is the general telegraph system of Europe, aided by the duplex system of transmission. The Hughes, Wheatstone and Baudot systems are also in service on busy circuits. There is some simultaneous telegraphy and telephony on the van Rysselberghe system. There is a good chapter on the line construction in 16 different European countries.

THE SIX-CHORD SPIRAL. By J. R. Stephens. New York: The Engineering News Publishing Co. 68 pages, illustrated. Price, $1.25.

This little book is devoted to the advocacy of a particular method of laying out railway curves. The language of the book is highly technical, so much so that it is difficult reading for any one not already familiar with the ordinary methods of laying out railway curves; nevertheless, the method itself is simple. To the uninitiated, it may be explained that "spiraling" a railway curve means so laying it out that there is no suddent transition from the straight track to the maximum curvature, but a gradual shortening of the radius of curvature, until a sufficiently sharp curve is attained. The object is, of course, to enable fast trains to pass around the curve with a maximum of safety and a minimum of discomfort to the passengers. The purpose of the present book is to show how, by the use of six intermediate arcs of progressively increasing curvature, the theoretical form of spiral can be so closely approximated that the practical operation of the curve is entirely satisfactory. Another advantage of the method is that the tables required are simpler than with the other methods of spiraling in common use.

Arc Circuit Switch.

The device shown in the accompanying illustrations, which has met with much favor in Great Britain, is designed for switching in street arc lamps in groups. A short interval of time is allowed between each group to admit of the lamps settling down to steady burning before the next group is

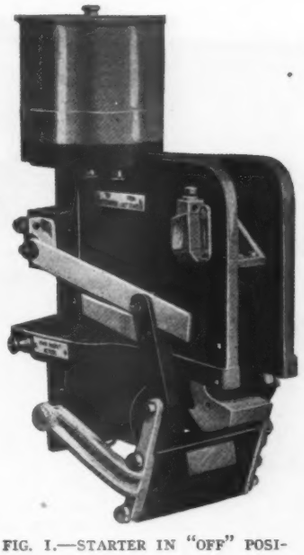


FIG. 1.—STARTER IN "OFF" POSITION.

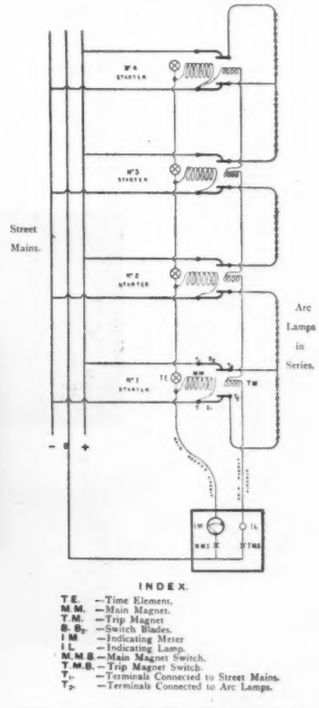


FIG. 2.—DIAGRAM OF CONNECTIONS.

switched on. It is contended that by this means a substantial economy is effected, as the whole system is operated at will from the central station or switching point, and all the lamps

can be put in circuit in a very few minutes or switched out together.

The switch is adapted for location in section pillars or lamp pillar bases. It consists (Fig. 1) principally of two parts, a

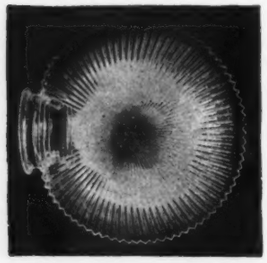
FIG. 3.—SECTION PILLAR.

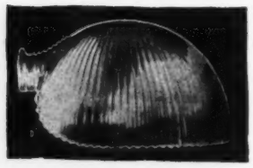
main switch operated by an electromagnet and a time element mechanism. A starter is placed in each group of lamps, and the main switch of the first starter having been operated from a small control switch in the central station, it sets in operation its own time element which closes after a predetermined interval the magnet circuit of the next starter and so on through the entire series. A smaller electromagnet is also placed on each starter to operate a tripping device for the main switch. On closing a second control switch in the station, all the switches may be thus tripped together.

A further modification may be introduced in the shape of two signal lamps in the central station indicating that the switches are "all on" or "all off" respectively. On the closing of the last main switch the "all on" signal lamp indicates that the circuits have been completed throughout. If through any cause a switch should fail to act, the signal lamp and an indicating galvanometer placed in the main magnet control circuit show the number of the delinquent starter. Fig. 2 is a diagram of circuits, and Fig. 3 shows one of the section pillars in Glasgow, Scotland, where the whole of the street arc lamps are controlled by this system.

Window Lighting.

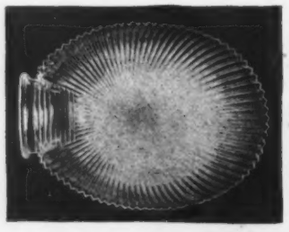
Window lighting may be divided into two classes, namely, where the lamps themselves are the attraction, and where lamps are used to properly illuminate the goods displayed. In the first class come saloons and places where no goods are displayed and the lamps simply are used for attracting attention. Unfortunately, this method is often used where the result desireed is to show the goods, as, for example, where rows of bare incandescent and electric lamps form the border of a display window. Owing to their being in the line of vision, they fail lamentably in producing proper results.

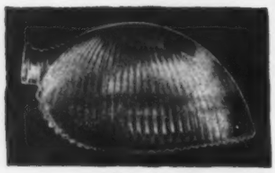


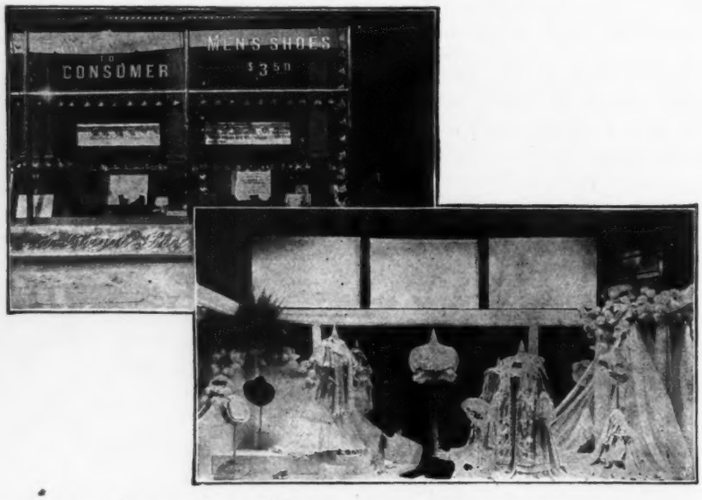


FIGS. 1 AND 2.—TOP AND SIDE VIEWS OF REFLECTOR.

The shrewd merchant has an eye for the comfort of every person that looks into his window. For a window where goods are shown, the lamp should be entirely hidden and at the same time the light from it concentrated on the goods displayed. When open-flame illuminants furnished the only means of illuminating show windows, merchants were faced with the problem, how to set his goods so that the light will fall on them in the right way. With the advent of electricity there came a change, and







FIGS. 3, 4 AND 5.—REFLECTOR AND EXAMPLES OF WINDOW LIGHTING.

the question then was, "How shall I place my lamps so as to display my goods to the best advantage?"

The Holophane Glass Company was quick to seize upon this opportunity, and has designed a reflector for use especially for window lighting, known as the Holophane reflectors for window lighting. They can be used advantageously where the lamps are placed either horizontally or vertically along the frames of the window. They have the advantage of not only concentrating the light strongly on the goods, but also of protecting the eyes from the glare of the filament, thus allowing the use of clear lamps, where otherwise only frosted lamps would be permissible. At the same time enough light passes through the prisms to make a pleasing appearance and add to the advertising value of the lamps. Where it is desired to hide the lamps entirely, they should be placed just above the top of the glass of the window. The Holophane reflectors will then concentrate the light and direct it downward, allowing just sufficient illumination for the ceiling. The reflectors can be slanted so as to illuminate a window of any depth or height. In case they are not placed higher than the top glass, a black band should be painted on the glass of sufficient depth to hide the reflectors from observation from the street. A novel effect may be obtained by forming any desired sign in the black band, the light shining through the Holophane reflectors, making the letters stand out distinctly. The accompanying cuts illustrate two of the more popular forms of Holophane reflectors.

Electroplating Apparatus.

The plating equipment illustrated herewith has been designed for use with any of the common solutions for plating with copper, brass, bronze, nickel or zinc. Arrangement is made for revolving the containing cylinder at a speed varying with

ELECTROPLATING EQUIPMENT.

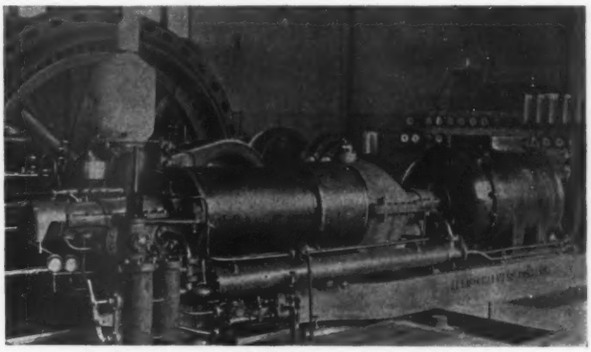
the voltage applied between the electrodes and with the nature of the solution and the material to be plated. It is stated that in general for an e. m. f. of 3 volts the speed should be about 2 r. p. m., while for 4 volts it should be about 3 r. p. m.

This plating equipment is manufactured by the Zucker & Levett & Loeb Company, New York. It is furnished ready for immediate use.

Test of Steam Turbo-Generator.

The accompanying illustration shows a 500-kw Allis-Chalmers turbo-alternator unit installed in the power house of the Western United Gas & Electric Company, Aurora, Ill. The alternator is a two-pole, two-phase 60-cycle machine wound for 2200 volts and 114 amperes per phase. The turbine was built to operate normally with steam at a pressure of 14 lbs. per sq. in. and a vacuum of 28 ins.

This unit was subjected to a series of tests recently by Mr. H. L. Rice, general manager, and Mr. W. M. Willett, electrical



TURBINE AND ALTERNATOR AT AURORA, ILL.

engineer of the above-mentioned company. Two tests at 77.5 per cent full load and 114 per cent full load have been reported as follows:

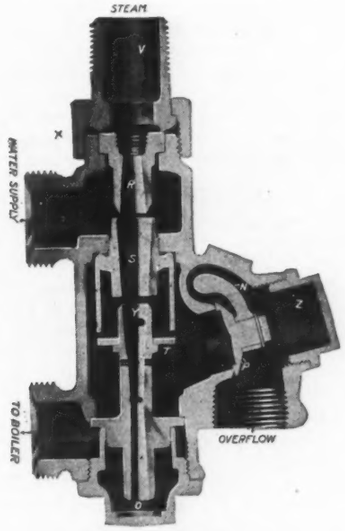
TESTS OF 500-KW TURBO-ALTERNATOR.

Per cent of rated load	77.5	114.0
Average load, kw	385.8	570.8
Duration of test, hours	4	4
Steam pressure at turbine throttle, gauge	142.4	143.3
Steam pressure at turbine inlet, gauge	87.0	123.02
Vacuum turbine exhaust, in	27.57	26.77
Barometer, in.	29.45	29.5
Vacuum at turbine referred to 30-in. barometer, in.	28.08	27.42
Revolutions per minute	3600	3600
Total water used corrected for temperature, lbs.	34,552	48,544
Drips from steam header, lbs	397	318.75
Drips from separator, lbs	91.5	68.25
Temperature of feed water, degrees F	84.16	78.8
Boiler leakage, total lbs	1927	1927
Moisture in steam by calorimeter, per cent	4.48	5.12
Actual weight of water chargeable to turbine, lbs.	30,612.01	43,878.23
Actual consumption dry steam per kw-hour	19.83	19.21

Load for the turbine unit was provided by a water rheostat, so that the power factor was unity.

Automatic Injector.

The accompanying illustration shows an injector that is claimed to be perfect in its automatic starting qualities. That is to say, if when the injector is working the flow of water be



AUTOMATIC INJECTOR.

suddenly interrupted, the injector will automatically reestablish the flow without attention. This device is manufactured by the Pemberthy Injector Company, Detroit, Mich.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The unseasonable weather which continued throughout the week retarded retail trade and agriculture to an extent that cannot yet be measured, but the loss will be considerable. May thus far has brought complaints of excessive cold from almost every section of the country, and in many cases it is found that mercantile collections have been slow on that account. Despite the slowness of retail trade and collections, however, there are few complaints coming from jobbing and wholesale lines, except that filling-in orders are light and that retail stocks are reported heavy. Demands from wholesalers, therefore, while smaller than some months ago, have been sufficient to keep all actively engaged. Freight congestion is relieved and traffic is very heavy, partly in preparation for fall and winter business, which is viewed with confidence, while last year's pressure causes a big movement of coal and attractive prices bring a vast tonnage of wheat to primary markets. Railway gross earnings in April were 15.5 per cent larger than in 1906. Manufacturing plants are kept close to maximum activity, pig iron and anthracite coal production exceeding previous records, and prices of all commodities are higher than on April 1, but 1 per cent lower than on March 1. Foreign commerce at the port of New York for the week showed a gain of $3,357,831 in imports and a loss of $1,768,826 in exports, as compared with the volume the year previous. The iron and steel industries are actively engaged; current production is, in fact, at the maximum, and the other industries, particularly building, are being actively pushed. Labor disturbances, taken as a whole, are not serious, excepting at San Francisco, where business has been brought to a complete standstill by strikes of street car hands and telephone operators, and at New York, where a nearly general strike of dock laborers has caused much interruption to the movement of freight. Further strength has developed in the foundry pig iron markets. Crude steel is very scarce in the central west and most of the probable product of the year has been sold. As a result of the high prices demanded for pig iron, engines have been advanced, and quotations on machinery and tools are likely to move upward. Makers of agricultural implements have purchased steel bars more freely, but bar iron is lower. Orders for structural steel were moderate. Copper was dull and lower, owing to the fact that when prices were advancing the week previous some large quantities were offered at concessions, which in turn deterred European demand and whatever domestic inquiry there was. There were a number of round sales of lake and electrolytic through the week at prices unchanged from the previous week: Lake, 26c.; electrolytic, 25 a 25¼c., for July shipments. *Bradstreet's* reports 154 business failures during the week ending May 9, against 163 in the previous week and 162 in the corresponding week last year.

SALES OF RELIANCE ENGINE SETS.—The "Reliance" Reynolds-Corliss engine, built by the Allis-Chalmers Company, Milwaukee, was designed primarily for driving electrical and other fast running machinery. It has now been on the market a little less than three years, during which time hundreds of engines of this pattern have been sold and put in operation, under widely varying operating conditions, in factories of all kinds, flour mills, saw mills, electric light and power plants, ore reduction works, etc., and without exception it has given unqualified satisfaction. The Lodge & Shipley Machine Tool Company, of Cincinnati, Ohio, has purchased one of these sets comprising an 18 in. x 36 in. "Reliance" engine direct coupled to a 200-kw, 240-volt engine type generator. The unit will be used for lighting and power service. Other sales of "Reliance" sets recently made are as follows: W. J. Rainey, Connellsville, Pa., a 20 in. x 36 in. "Reliance" engine, direct coupled to a 250-kw engine type direct current generator; the Jeanerette Electric Light Plant, of Jeanerette, La., one 14 in. x 24 in. "Reliance" engine direct coupled to a 100-kw engine type, direct current generator; the Chattanooga Implement & Manufacturing Company, Chattanooga, Tenn., one 16 in. x 30 in. "Reliance" engine, direct connected to a 150-kw engine type, alternating current generator, together with exciter, switchboard and seven standard Allis-Chalmers induction motors; W. S. Mershon & Company, Saginaw, Mich., one 12 in. x 30 in. "Reliance" engine, direct connected to a 75-kw alternating current generator; the city of Waynesboro, Waynesboro, Ga., one "Reliance" engine 14 in. x 30 in., and a 125-kw alternating current generator.

GROWTH AT SEATTLE.—Advices from Seattle state that the street railway, electric lighting and gas companies are finding it difficult to keep pace with the rapid growth of the city. The Seattle Electric Company, which operates the street car service, reports an increase of 20 per cent in the number of passengers carried last year, and the present indications are that the increase for 1907 will be even larger. The line from Seattle to Tacoma is being double tracked and it is expected at least twenty miles of track will be added to the city system during this year. The Seattle Lighting Company recently sold the site of one of its old plants to the Union Pacific Railroad for $1,020,000, and with $970,000 of this amount it is erecting a new gas generating plant with a capacity of 700,000,000 cubic feet per annum. The sales of gas of this company increased over 70,000,000 cubic feet last year and the expected increase for this year is at least 75,000,000 cubic feet.

GENERAL ELECTRIC OFFICERS.—The stockholders of the General Electric Company held their annual meeting at Schenectady on May 14. These directors were elected: Gordon Abbott, Oliver Ames, T. Jefferson Coolidge, Jr., Frederick P. Fish, George L. Gardner, Henry L. Higginson, Robert Treat Paine, 2d, of Boston; C. L. Coffin, J. Pierpont Morgan, S. L. Schoonmaker, Charles Steele, of New York; W. M. Crane, of Dalton, Mass.; Marsden J. Perry, of Providence, R. I.; J. P. Ord, of Albany, and E. W. Rice, Jr., of Schenectady. Marsden J. Perry was elected to succeed the late Gen. Eugene Griffin as first vice-president, and S. L. Henderson to succeed T. K. Henderson, resigned. The stockholders voted to approve the change in the by-laws providing that hereafter no officer of the company except the president need be a member of the board of directors. The new board of directors is to meet at a later date and elect officers.

THE B. F. STURTEVANT COMPANY, of Boston, Mass., reports sales of electric propeller fans as follows: The Jeffrey Manufacturing Company, Columbus, Ohio; Victor Talking Machine Company, Camden, N. J.; Samuel Jackson Company, Pawtucket, R. I.; Heyl & Patterson, Pittsburg, Pa.; E. Greenfield's Son & Company, Brooklyn, N. Y.; Ingersoll-Rand Company, Phillipsburg, N. J.; Wosterburg & Williams, New York City; Goodman Manufacturing Company, Chicago, Ill.; Wheeler-Green Electric Company, Rochester, N. Y.; Corbin Motor Vehicle Corporation, New Britain, Conn.; Thos. G. Plant Company, Jamaica Plain, Mass.; Ideal Lunch, Boston, Mass.; Jackson & Co., Boston, Mass.

WIRELESS ON WARD LINE.—The Ward Line, after giving wireless telegraphy a thorough test on its new steamers "Merida" and "Havana," has arranged to install the De Forest system on all its passenger ships plying between New York, Cuba, Mexico and Nassau. The following steamers will be equipped: "Mexico," "Morro Castle," "Monterey," "Esperanza," "Vigilancia," "Segurancia" and the new steamer "Saratoga," which will go into commission in June.

THE NEW YORK INTERBOROUGH COMPANY has just placed a large order with the Electric Cable Company, of 17 Battery Place, New York City, for flexible mesh rail bonds, which will hereafter be used exclusively by it. To meet the rapidly growing demand for this product the Electric Cable Company is building an extensive addition to its plant, at Bridgeport, Conn.

NAVY EQUIPMENT.—Bids will be received until June 1 by the Bureau of Yards and Docks, Navy Department, for furnishing economizers, fans, engines, flues, etc., for the power plant at the navy yard at Portsmouth, N. H., as per specification No. 1540. The cost of the plant is estimated at $15,000.

EQUIPMENT FOR LAWRENCE GAS COMPANY.—The Lawrence Gas Company, of Massachusetts, which operates both gas and central station service in the city above named, has recently completed an extension of its power plant on the shores of the Merrimac River. The recent installation consists of two 500-kw Curtis-General Electric turbo-alternators designed for operation at 2300 volts, 60 cycles; two Babcock & Wilcox water tube boilers of 524 hp each, nominal rating, and a 900-kw General Electric generator of the revolving field type, direct coupled on the same shaft with a Holyoke Machine Company water wheel installation. Each turbine has its own complete condensing plant with Worthington surface condensers. A reinforced concrete stack was built in connection with the power house addition, and the new installation should enable the company to handle its electrical load to much better advantage than was possible with the belt-driven equipment in the original station. Mr. C. J. R. Humphreys is the agent in charge of the company's management.

LIGHTING IN NEWARK, N. J.—It is evident that there is a difference of opinion over the proposal to install a municipal lighting plant at Belleville, N. J., to furnish electricity for Newark, between the Board of Works and the special Municipal Lighting Committee of the Common Council. The Board of Works believes there is no money to be saved by a municipal plant, and is about to consider an estimate from the Public Service Corporation on the cost of furnishing electricity to the city. The Committee of the Common Council favors a municipal plant and recommends a special election June 11 for the people to vote on the matter. The plant will cost $1,200,000, it is estimated, and it is alleged that as much as $100,000 a year will be saved.

LIGHTING AT FORT RILEY, KAN.—Sealed proposals in triplicate will be received here until 11 a. m., June 1, 1907, and then publicly opened for furnishing and installing electric light fixtures in buildings at this post. Information will be furnished on application. The government reserves the right to reject any or all bids or any part thereof. Envelopes containing proposals to be endorsed "Proposals for Electric Fixtures" and addressed to Captain W. M. Whitman, constructing quartermaster.

GENERATING SETS.—Among recent sales of generating sets made by the B. F. Sturtevant Company, of Boston, Mass., are the following: Isador Fajans, New York City; Augusta Lumber Company, Augusta, Me.; Norfolk & Washington Steamboat Company, Newport News, Va.; North Packing & Provision Company, Somerville, Mass.; Fisheries Company, Philadelphia, Pa.; Lincoln Manufacturing Company, Fall River, Mass., and Hudson Companies, New York City.

TRAIN LIGHTING ORDER.—Among orders recently received by the Bliss Electric Car Lighting Company, of Milwaukee, is one from the Baltimore & Ohio Railroad to light the Royal Blue Limited trains with the Bliss system of electric car lighting.

Financial Intelligence.

THE WEEK IN WALL STREET.—Unfavorable crop news caused a tendency in stock quotations to recede and the disappointment in speculative circles attending the final announcement of the Union Pacific financing also had an unfavorable effect. The market was very irregular as a result of these influences. Early in the week there was a bearish feeling. In addition to all this the money market showed a tendency to become harder on the strength of foreign exchange rates. Some rather unfavorable reports of railroad earnings for March also had a depressing effect on sentiment, as the figures seemed to indicate rather clearly that the bad weather of the late winter and early spring had actually cut down revenues and had also increased the ratio of operating cost in many instances. Practically all classes of stocks were more or less affected. At the close of the week, however, the market showed a better tone, although the activity was professional. With one or two exceptions electric securities closed lower than a week ago, the heaviest decline being 6 points in Metropolitan Street Railway, which closed at 94. New York & New Jersey Telephone, Western Union Telegraph and Westinghouse made slight gains. In the curb market, trading in rights to the new Harriman securities became the feature during the latter part of the week, but was so light as to cause disappointment. There were no other incidents. Following are the closing quotations of May 14:

NEW YORK.

	May 7	May 14		May 7	May 14
Allis-Chalmers Co.	11⅞	11¾	General Electric	148	146
Allis-Chalmers Co. pfd.	31¾	31	Hudson River Tel.	—	—
Am. Dist. Tel.	—	—	Interborough Met. com.	24½	23½
American Locomotive	63	62	Interborough Met. pfd.	58½	56⅞
Amer. Locomotive pfd.	108	108	Mackay Cos.	—	—
American Tel. & Cable.	75	75	Mackay Cos. pfd.	—	—
American Tel. & Tel.	—	—	Marconi Tel.	—	—
Brooklyn Rapid Transit.	60¾	60	Metropolitan St. Ry.	—	—
Electric Boat	33	36	N. Y. & N. J. Tel.	—	—
Electric Boat pfd.	81	81	Western Union Tel.	82½	82½
Electric Vehicle	—	—	Westinghouse com.	143¾	144
Electric Vehicle pfd.	—	—	Westinghouse pfd.	—	—

BOSTON.

	May 7	May 14		May 7	May 14
American Tel. & Tel.	124¼	124	Mass. Elec. Ry. pfd.	—	57¾
Cumberland Telephone.	—	—	Mexican Telephone	—	—
Edison Elec. Illum.	204	208	New England Telep.	120	119
General Electric	—	—	Western Tel. & Tel.	—	—
Mass. Elec. Ry.	16¼	—	West. Tel. & Tel. pfd.	—	71

PHILADELPHIA.

	May 7	May 14		May 7	May 14
American Railways	49½	49½	Phila. Electric	8¼	8⅜
Elec. Co. of America	10	10	Phila. Rapid Trans.	25⅜	24¼
Elec. Storage Battery	52	50½	Phila. Traction	94	—
Elec. Storage Bat. pfd.	—	—			

CHICAGO.

	May 7	May 14		May 7	May 14
Chicago City Ry.	—	180	National Carbon	—	71¼
Chicago Edison	—	—	National Carbon pfd.	—	110
Chicago Subway	17¾	—	Union Traction	—	—
Chicago Tel. Co.	127	—	Union Traction pfd.	—	—
Metropolitan Elec. com.	—	23			

ATLANTA EARNINGS.—The Georgia Railway & Electric Company has filed with the state comptroller general its annual tax returns,, showing a total property value of $3,712,368, of which amount the franchise represents $1,583,855. This is an increase of $207,881 over the returns of last year. The company gives its gross receipts for the year as $2,321,816 and its net income as $696,467. The present capitalization, inclusive of bonded indebtedness, and old and new stock is $19,878,000. The Atlanta & Northern Railway, a subsidiary company to the above corporation, was returned at $182,585, of which the franchise was valued at $14,994. The gross receipts were reported to be $118,505, and the net income $21,081. The Georgia Railway & Electric Company has bid 25 per cent lower than last year on city lighting, meeting the competition of the North Georgia Electric Company, a new company. The old company's bid will probably be accepted. The new company offers electrical energy to commercial and domestic users at rates much cheaper than at present.

CHICAGO EDISON NOTES.—Advices from Chicago state that the nine houses handling Chicago Edison's $5,000,000 note issue have much less than $1,000,000 left for sale. There was no difficulty placing these notes with the public. Since May 1 they have been sold at the same rate, 97⅜. After providing for the floating debt the company will spend the proceeds on new construction and improvements, which this year will call for between $3,000,000 and $4,000,000, or only one-half as much as last year. Officials of the company are not pessimistic on the business situation, but believe the time has come for judicious economy in new work. They have in contemplation a very extensive programme of expansion in the next few years. A compilation of extraordinary improvements in and near Chicago the next five years aggregating $375,000,000 was recently published by a leading local paper and the Chicago Edison and Commonwealth Electric Companies were in the list for $40,000,000—$25,000,000 for the Edison and $15,000,000 for the Commonwealth.

HUDSON RIVER POWER.—The Hudson River Electric Power Company has filed an application with the New York State Gas and Electric Commission for consent to issue $3,232,000 consolidated and refunding mortgage bonds. The purpose is said to be to provide for the purchase of the flowage rights of a large reservoir on the Sacandaga River in the counties of Saratoga and Fulton and the construction of a dam and powerhouse at Conklingville, with the necessary transmission lines and sub-stations. The Hudson River Electric Power Company owns the entire capital stock of the Hudson River Electric Company, of the Saratoga Gas, Electric Light & Power Company and of the Ballston Spa Light & Power Company, more than a majority of the stock of the Hudson River Water Power Company and an interest in the stock of the Empire State Power Company. The company has $5,777,300 stock and $4,100,000 bonds outstanding.

LONG ISLAND RAILROAD.— In the recent annual report of the Long Island Railroad, President Peters said: "Plans are being prepared for the electrification of your lines from Long Island City to Port Washington and to Whitestone Landing, and as soon as the tunnels under the East River are completed your lines will be electrified to Jamaica and to Woodhaven Junction, via the Glendale cut-off, a connection between the main line of your company, the Montauk Division, and the Rockaway Beach Division. Plans are also being made for an enlarged terminal at Jamaica, where the change from steam to electric locomotives will be made." The Long Island Consolidated Electrical Companies, which was organized in 1905 by the Long Island Railroad to acquire suburban trolley lines, has completed the acquisition of a one-half interest in the New York & Long Island Traction Company, and in the Long Island Electric Railway Company, and has also purchased, the report says, the Babylon Railroad, a small line in the village of Babylon. The company has also planned the construction of a cross-island line from Huntington to Babylon via Farmingdale and Amityville, and the necessary franchises for this extension have been secured. It is proposed to obtain the funds for this purpose through the sale of the Electrical Companies' bonds, guaranteed by the parent company.

SUSQUEHANNA POWER.—A special meeting of the stockholders of the Susquehanna Power Company has been called for Tuesday, May 21, at Conowingo, Md., for the purpose of increasing the capital stock from $3,500,000 to $5,000,000, the new stock to be issued as preferred. This company owns property along the Susquehanna River in the vicinity of Conowingo, and is controlled by New York and Philadelphia capitalists. It has never yet carried out its plan to build a power plant on the river, and was recently involved in litigation with another company on the Susquehanna. The Susquehanna Power Company's property is just below that of the Susquehanna Electric Power Company, in which considerable Baltimore capital was invested at the time of its organization. This company has also gone no further with its plans than the acquirement of property for a plant. Above the Susquehanna Electric Power Company's property is that of the McCall's Ferry Power Company. The latter is mostly in Pennsylvania and the company is now building a big plant on the river at McCall's Ferry. It is generally supposed that the Susquehanna Power Company will shortly make plans for starting work on its plant, though the company has, as yet, made no formal announcement.

NEW CABLE OUTLAY.—The new cable line from New York to Colon, which is to be completed by August 1, is to be financed by an issue of stock by the Central & South American Telegraph Company. At the same time the company proposes to give its stockholders a 25 per cent stock dividend representing sums spent out of earnings for new lines and improvements to the company's property. To carry out these plans a special meeting of the company's stockholders was held May 14 to authorize an increase in the company's stock from $8,000,000 to $12,000,000, half of the increase to be distributed as a stock dividend. The New York-Colon cable is being laid by the Central & South American Telegraph Company in cooperation with the Mexican Telegraph Company. Arrangements have been made for the use of the government's wires from Colon to Panama until the company can construct its own line across the Isthmus.

INCREASING TELEPHONE CAPITAL.—At a special meeting of the stockholders of the Columbus (O.) Citizens' Telephone Co., the board of directors was increased from 9 to 11. The directors voted to increase the capital stock to $1,750,000 by the addition of $500,000 6 per cent cumulative preferred stock. Of this $250,000 will be issued at once, and the remainder will be retained in the treasury for future extensions and improvements. The new stock will be sold to present stockholders pro rata and what remains will be sold to underwriters, if any remains. The reports of the officers show that the company had on April 1, 10,180 telephones in the city and 2,427 in the country, an increase of 49.7 per cent since the installation of the automatic exchange.

LONG ACRE LIGHT.—The directors of the Long Acre Electric Light & Power Company, New York City, have elected the following officers: President, Edgar Van Etten; vice-president, Hon. John C. Sheehan; fiscal agents, Lamprecht Brothers, of New York and Cleveland. In a statement President Van Etten said that not only has the company the right to generate and distribute electricity for light, heat and power, but also the rights, under the decision of the Court of Appeals, to establish telephone lines and that the company is now in negotiation with some of the independent telephone companies for a grant of privileges under its franchise, the company reserving to itself all rights for the distribution of electricity for all other purposes.

RHODE ISLAND DEFALCATION.—The Rhode Island newspapers state that a shortage of $92,000 in the Woonsocket Electric Machine & Power Company has been disclosed. The disclosure was followed by the resignation of the secretary-treasurer of the company and it is claimed that he has turned over property amounting to $40,000. Negotiations which have been going on for the sale of the business to Estabrook & Company will not be interfered with because of this loss, as they are part of a general consolidation scheme at Woonsocket, taking in the gas interests as prime movers in the transaction.

BOSTON EDISON STOCK.—At the auction recently of 10,902 new shares of Boston Edison Company stock, bids were not received for blocks of less than 50 shares. The upset price set by the directors was $195 per share. The opening sale was 105 shares at 204¾. The second sale was 500 shares at 204⅜. Third sale was 100 shares at 204¼. At the auction sale of Edison new stock in the first fifteen minutes 3701 shares were sold at prices ranging from 204¾ to 203, mostly in blocks of 100 shares. The attendance was large and the bidding brisk. The last block sold at 202¾.

THE METROPOLITAN LIGHT & POWER COMPANY, of San Francisco, formerly the San Francisco Coke & Gas Company, has given notice of its intention to increase its capital stock from $5,000,000 to $10,000,000, and will also increase its bonded indebtedness from $2,500,000 to $7,500,000. The directors of the company at the present time are: Leopold Michels, president; Charles G. Lyman, secretary; Leopold Wallach, Frederick H. Eldridge, Sigmund Stern, Beach Thompson and Charles P. Eells.

BOSTON ELEVATED.—At a special meeting of the Boston Elevated Company it was voted to authorize an issue of $5,800,000 bonds and $8,000,000 stock. The stock will be offered to stockholders at a price to be determined by the railroad commissioners. The proceeds of the stock will be used for paying for the construction of the Cambridge subway, while the sale of the bonds will provide funds for the power additions, new equipment and the Forest Hill extension.

NIAGARA POWER.—The New York State Gas & Electric Commission has approved the application of the New York & Ontario Power Company for a certificate of authority to do business and consent to the issuance of $150,000 in stock and $150,000 in bonds. The company will sell electricity for light, heat and power in the city of Ogdensburg, the village of Waddington, and the towns of Waddington and Lisbon.

KEYSTONE TELEPHONE.—The gross earnings of the Keystone Telephone Company of Philadelphia (combined companies) for the month of March amounted to $85,396, an increase of $15,666, and net earnings to $43,537, an increase of $14,391, as compared with last year. From July 1 to March 31 the gross earnings aggregated $732,480, an increase of $127,707, and net earnings, $341,616, an increase of $69,766.

MORTGAGE IN PORTLAND, ORE.—The Portland Railway, Light & Power Company has filed a mortgage for $15,000,000 in favor of the Trust Company of America, covering all its properties, to provide for taking up underlying bond issues against subsidiary corporations owned by the company and to provide for extensions and improvements.

SALE OF TROLLEY SECURITIES.—The Maryland Electric Railways Company of Baltimore has sold $750,000 of the Baltimore & Annapolis Short Line 5 per cent bonds to New York bankers. The Short Line prior to consolidating with the Maryland Company authorized an issue of $1,000,000 of bonds to defray the cost of electrifying the road.

WAGNER INCREASE OF STOCK.—The forthcoming increase in the stock of the Wagner Electric Company, of St. Louis, from $800,000 to $1,200,000 is due to the expansion in the business of the company. It is understood to have closed a very successful first quarter in 1907.

GENERAL NEWS

Construction News.

COLUMBIANA, ALA.—The City Council has granted I. Gordon, of Columbiana, a franchise for an electric light plant to cost $2,000.

QUITMAN, ARK.—The citizens of this place are considering a project to construct an interurban railway to Conway and an organization has been formed, of which R. L. Kane is president and W. T. Hammock, secretary, to carry out the project.

RUSSELLVILLE, ARK.—This town has granted the Southern Traction & Power Company, of Pine Bluff, a franchise for an electric lighting plant and water works system. The company will also operate an electric railway from Russellville to Dover.

ARMONA, CAL.—The town is now lighted by electricity from the plant of H. G. Lacey Company, of Hanford. A power service has also been established and it is expected that many motors will be installed during the summer. The San Joaquin Light & Power Company, of Fresno, furnishes the electric energy for operating the system of the H. G. Lacey Company.

BAKERSFIELD, CAL.—Power was turned on May 3 for the first time on the Edison Electric Company's power line from its Kern River plant to Los Angeles as a test, the result of which proved to be satisfactory. The line is designed for 60,000 volts, and the test showed 60,940 volts. It has been decided that the formal opening will take place about the middle of May.

EUREKA, CAL.—Application has been made to the City Council by E. C. Sharpe for the sale of a telephone franchise. Mr. Sharpe proposes to install an independent telephone system and will place the wires underground in the business district of the city.

FOREST, CAL.—An electric power plant is to be erected at the junction of the Wild Canon and the North Branch of Kanakakab Creek. The plant will furnish electricity for the operation of air compressors, for power drills for a 40-stamp quartz mill, an electric lighting plant, trams and saw mill. The system will be built and operated by an eastern syndicate.

NAPA, CAL.—The Board of Supervisors has passed an ordinance granting a franchise to Henry Brown for a term of 45 years to erect and maintain transmission lines over certain roads and highways in Napa County, for transmitting electricity for light, heat and power purposes. The franchise was sold to Mr. Brown for $25.

RIVERSIDE, CAL.—The Crescent City Railway Company has made application to the City Council for a franchise to operate a street railway on certain streets in the city. Bids will be received until May 24 for the franchise.

SANTA CLARA, CAL.—Bids will be received until May 23 for $21,000 in bonds for the repair of the electric light plant and the water works system. C. J. Fenton is city clerk.

SANTA MARIA, CAL.—The Santa Maria Gas & Power Company has asked the Board of Trustees for a franchise for an independent electric light and power plant in connection with its gas plant. The Valley Electric Company now operates here.

TRINIDAD, COL.—The Trinidad Light & Power Company and the Trinidad Electric Railroad Company have purchased the plant and holdings of the Las Animas Light, Power & Manufacturing Company, and will assume control of all the electric and gas utilities of the city at once. C. H. Paul, the retiring manager of the Las Animas Company, has purchased the entire supply business of both corporations and will soon file papers for the incorporation of the Trinidad Gas & Electric Supply Company.

HARTFORD, CONN.—The Connecticut Home Telephone Company has applied for a charter. The company will have a capital stock of $100,000.

MOODUS, CONN.—At a meeting of the promoters of the Moodus & East Hampton Tramway Company held recently the company was formally organized and the following officers were elected: George F. Marshall, of Malden, Mass., president; Fred M. Hoadley, of Providence, R. I., secretary and treasurer.

NORWICH, CONN.—The Uncas Power Company has awarded the contract for the construction of the electric power plant, which it is to erect on the Shetucket River at Scotland Station, to Frederick C. Shaw, of Providence. Contracts have been placed with the General Electric Company for electrical equipment for the power house, and with the S. Morgan Smith Company for water wheels.

SHARON, CONN.—The Sharon Electric Light Company has withdrawn its petition to the Legislature for permission to extend its lines to Lakeville and Salisbury.

WILLIMANTIC, CONN.—The petition of the Willimantic Gas & Electric Light Company to increase its capital stock by $100,000 has been refused by the Legislature.

GREEN COVE SPRINGS, FLA.—A. A. Kind, Jacksonville, has secured the contract for constructing the water works system and electric light plant in this place.

ATLANTA, GA.—Bids for lighting the city of Atlanta have been submitted by the Georgia Railway & Electric Company and the North Georgia Electric Company. For a five-year contract the Georgia Railway & Electric Company agrees to furnish the first year arc lamps for $60 each, and incandescent lamps, $28 each; second year, $59 and $27.50; third year, $58 and $27; fourth year, $57 and $26.50; fifth year, $56 and $26. For three-year contract: $65 and $28 per year. For two-year contract: $75 and $33.75 per year. For one year, $79.50 and $37.50 per year. No bid was made for furnishing electricity for commercial and domestic purposes. The bid of the North Georgia Electric Company was as follows: For one year, arc lamps, $65 each per year, incandescent lamps, $28 each per year. For five years: arc lamps, $64 each per year, incandescent lamps, $27 each per year. Electricity for commercial and domestic purposes not more than 10 cents per kw-hour, and for power purposes not more than 6 cents per kw-hour. Under the present contract with the Georgia Railway & Electric Company the city is paying $75 per year for arc lamps and $33.75 for incandescent lamps.

ANNA, ILL.—The State Legislature has passed a bill appropriating $40,000 for a power plant for the Hospital for Insane at Anna, and $15,000 for a power plant for School for the Blind.

CAIRO, ILL.—The Cairo Electric & Traction Company has awarded the contract for the complete construction of the extension of its lines to the Electrical Installation Company, Chicago, Ill.

FREEPORT, ILL.—The City Council has passed and the Mayor has approved an ordinance granting a franchise to Charles E. Gregory to construct and operate an electric light and power plant in Freeport.

GREENFIELD, ILL.—J. T. Vallaway has purchased the new electric light plant from Lewis Soloman.

PAXTON, ILL.—The Paxton Telephone & Telegraph Company is planning additions and improvements which will more than double the present capacity of its plant, and is receiving estimates on poles, wires, conduits, switchboards, etc.

ROCKFORD, ILL.—Plans have been completed by the Central Heat & Power Company for its extension to the east side. The company is planning to furnish electricity for lighting in the business district of the city.

TAYLORVILLE, ILL.—W. B. Adams is interested in the organization of an electric light, heat and power plant, which, he states, will be in operation within a short time.

EVANSVILLE, IND.—The School Board is preparing to build a manual training school building and in connection therewith will construct and equip a model power house to supply heat, light and power for the entire building. Major A. C. Rosencranz, a member of the school board, will probably furnish the money for the power plant.

INDIANAPOLIS, IND.—The directors of the Indiana State Board of Agriculture have decided to erect water works and an electric light plant on the State Fair Grounds.

DES MOINES, IA.—The State Board of Control on May 8 awarded to the Murray Iron Works, of Burlington, and the Westinghouse Electric & Manufacturing Company contracts for engines and generators at the state institutions at Clarinda, Glenwood, Independence and Marshalltown. The total cost is $30,000.

DUBUQUE, IA.—The Eastern Iowa Traction Company has applied to the City Council for a franchise to use the streets of the city for a street railway system. A. Hurst, O. M. Caffery and H. M. Tracy are the trustees of the company.

ELLIOT, IA.—The directors of the Elliot Central Telephone Association have voted to purchase a new switchboard the same capacity as the one now in use to meet the increased demands of service.

IOWA CITY, IA.—The Farmers' Mutual Telephone Company has increased its capital stock from $4,500 to $9,000. W. M. Hartsock is president.

KEOKUK, IA.—The Mississippi Valley Telephone Company is contemplating the construction of a new exchange building in this place at a cost of $7,800.

SIOUX CITY, IA.—Plans are being considered for the construction of a municipal electric lighting plant in this city.

KANSAS CITY, KAN.—The Kansas City & Olathe Electric Railway has applied to the County Commissioners of Wyandotte County for a 35-year franchise to operate a street railway system in this county.

NEWPORT, KY.—The City Council has adopted an ordinance providing for the sale of the telephone franchise. The franchise is for a term of 20 years and provides for laying of two miles of conduits the first year and one-half mile each year hereafter. The company is to pay the city $2,500 each year and give a bond of $5,000.

HOULTON, MAINE.—The Bangor & Aroostook Railroad is contemplating the construction of a large central light and heating plant for its

various buildings and yard in this town. The project will involve an expenditure of about $30,000.

BALTIMORE, MD.—The Maryland Telephone & Telegraph Company and the Baltimore Electric Power Company have been consolidated under the name of the Baltimore Electric Company. The authorized capital stock of the new company is $3,400,000, and the officers are: David E. Evans, president; Sydney L. Wright, first vice-president; B. S. Josslyn, second vice-president and general manager; W. T. Spring, secretary, and B. F. Bonsal, treasurer. It is said that the company is contemplating enlarging its electric plant at Ferry Bar.

AMHERST, MASS.—The Connecticut Valley Power Company is now erecting its transmission line from Turners Falls to the electric light station of the Amherst Gas Company. The line will be 17 miles long. The company will furnish electricity to light Amherst, Pelham, Sunderland, Hatfield and other towns in this vicinity and will also furnish electrical power for manufacturing purposes. E. D. Marsh, C. F. Deuel, David Barry, of Amherst, are interested in the company.

CHICOPEE, MASS.—The Board of Aldermen has passed on first reading, the ordinance appropriating $19,000 for changes and enlargement in the electric light plant.

EASTHAMPTON, MASS.—The Barnett Drop-Forge Company is planning to operate its plant by electricity, which will be supplied by the Easthampton Gas Company.

FITCHBURG, MASS.—The Fitchburg Gas & Electric Light Company has petitioned the City Council for permission to locate poles and wires on Wanoonsnoc Road so as to enable the company to furnish electricity for operating the plant of the Fitchburg Brick Company. The Fitchburg Company proposes to install a dynamo to operate a brick making machine having a daily capacity of 40,000 bricks.

MILLER'S FALLS, MASS.—The Franklin Electric Company has submitted a proposition to the town officials to furnish electricity for operating the municipal electric lighting system. The company offers to furnish electricity for 3½ cents for the first 40,000 kw-hours, 3¼ for the next 10,000, and 3 cents for all above that amount. The minimum annual charge of $1,200 must be made. The company agrees to build the line and deliver electricity to the switchboard at Miller's Falls. Power for operating the plant is now furnished by a gasoline engine at a cost estimated at about 11½ cents per kw-hour.

NATICK, MASS.—The lighting committee has decided to contract with the Edison Electric Illuminating Company and with the Welsbach Company for lighting the streets of the town. The Edison Company is to furnish 161 incandescent lamps of 32 cp and 12 arc lamps for $3,845 per year.

NEW BEDFORD, MASS.—Governor Guild has signed the bill, recently passed by the Legislature, which allows the New Bedford & Onset Street Railway Company to conduct an electric lighting business. The company proposes to furnish electricity for lighting purposes in the towns through which the street railway passes.

SALEM, MASS.—The Boston & Maine Railroad Company has recently installed a 75-hp electric motor in its car shops in Salem to operate the machinery by electricity.

HANCOCK, MICH.—A. F. Macdonald, city clerk, writes that the question of constructing a municipal electric light plant is being considered, but nothing definite has yet been done.

PAINESDALE, MICH.—The Champion Mining Company has completed its new electric lighting plant and is furnishing electricity for lighting the streets and residences of Painesdale. Trimountain and Baltic. The company is also installing an independent telephone system in the three towns.

UNION CITY, MICH.—The citizens are contemplating equipping the municipal electric lighting plant with a new steam power plant at a cost of about $5,000.

FERGUS FALLS, MINN.—Vernon A. Wright is reported interested in the construction of a dam at Dayton for the development of water power for electrical purposes.

FORT SNELLING, MINN.—Bids will be received until June 1 by J. E. Sawyer, chief quartermaster U. S. A., St. Paul, Minn., for installing electric fixtures and making service connections in four N. C. O. Quarters at Fort Snelling.

LIDGERWOOD, MINN.—A company has been organized by J. L. Mathews and L. J. Christensen for the purpose of erecting a telephone system in and around Lidgerwood. The company is capitalized at $25,000.

NORBORNE, MO.—The Stet-Rockingham-Norborne Telephone Company has decided to build an exchange building in Prairie township. The building with other improvements will cost about $3,000.

HELENA, MONT.—The Montana Independent Telephone Company is planning to construct a conduit system to place its wires underground in this city.

CLAREMONT, N. H.—Work has commenced on the construction of the dam and power house for the Claremont Power Company on the Black River, at Cavendish Gorge, Vt. The power station is to be equipped with three turbine wheels of 750-hp each, direct-connected to three 500-kw generators. The transmission lines are to be brought across country to Claremont, a distance of 20 miles. It is expected to have the plant completed by Dec. 1.

CAMDEN, N. J.—The Pennsylvania Railroad Company has ordered 21 new cars and additional equipment for the power station to meet the demands of the increased traffic on the Camden-Atlantic City Electric Trunk Line. The company has placed an order with the General Electric Company for an additional Curtis steam turbo-generator set. The boiler capacity will be increased and transformers will be installed. A small horizontal Curtis turbo-generator of 76-kw capacity will also be added to the present equipment. Six 1000-kw rotary converters and eight air-blast transformers will be installed at the sub-stations at North Camden, Glassboro, Newfield, Ridpath, Atlantic City and Westville.

DOVER, N. J.—E. L. Thompson, president and treasurer of the manufacturers' Automatic Sprinkler Company, of New York, N. Y., has purchased the entire stock of the Dover Electric Light Company. Mr. Thompson, it is said, will spend about $60,000 in improvements to the plant at once.

NEWARK, N. J.—Mayor Jacob Haussling on May 8 vetoed the two resolutions passed by the Common Council recently, providing for the installation in the city hall of an independent lighting plant to cost approximately $30,000.

NEWARK, N. J.—The Common Council on May 3, passed the ordinance granting the Newark Block Lighting Company permission to lay conduits in Lawrence and Market Streets, between Ward and Broad Streets and to engage in the business of selling electricity for lighting and power purposes. The ordinance has also been signed by the Mayor. James M. Seymour, Jr., is president of the company.

BROOKLYN, N. Y.—Bids will be received until May 20 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in School 94, Borough of Brooklyn.

FORT COVINGTON, N. Y.—Application has been made to the Village Board of Trustees of Saranac Lake by Paul Smith, Jr., and associates for a franchise to build and operate a street railway system in the village.

NIAGARA FALLS, N. Y.—The Governor has signed the bill appropriating $14,000 for an electric installation at the State reservation at Niagara.

PORT JEFFERSON, N. Y.—A franchise has been granted to the Suffolk Traction Company by the Highway Commissioners of Brookhaven, to construct and operate an electric railway across Long Island, between Port Jefferson on the sound and Patchogue on the ocean front.

SCHENECTADY, N. Y.—The Schenectady Illuminating Company has announced another reduction in its rates for electricity for lighting purposes to take effect with May reading of the meter. The rates are as follows: The first 30 kw-hours, or less, at ten cents; next 60 kw-hours, or less, at eight cents; next 120 kw-hours, or less, at seven cents, and balance at six and one-half cents per kw-hour. A discount of 10 per cent will be allowed on all bills paid within 15 days after the date of the bill.

WESTMORELAND, N. Y.—The citizens are considering the question of having the streets of the village lighted by electricity. A committee has been appointed to investigate the matter and will report at an adjourned meeting.

WHITESBORO, N. Y.—The Oriskany Hydro-Electric Company has been granted a franchise by the Town Board of Whitestown. The company was represented by T. F. McBride, who stated that the company was planning to build a large dam at Pleasant Valley, near Oriskany, and develop the water power at that place. An option has been secured on the property of the old Oriskany Woolen Company and a large power plant will be built. The cost of the plant is estimated at between $200,000 and $300,000. The company proposes to furnish electricity for operating the Utica Southern Railroad and also for lighting and power along the line as far as Norwich.

WINSTON-SALEM, N. C.—The Fries Manufacturing & Power Company is planning to extend its line to East Winston. A new company is being formed to build an electric railway from this city to Piedmont, a distance of two miles.

ASHLAND, OHIO.—Plans are being made by the Cleveland, Ashland & Mansfield Traction for the erection of a power house in this place.

ASHTABULA, OHIO.—The City Council is contemplating an expenditure of from $50,000 to $100,000 for improvements to the municipal electric lighting plant.

CANTON, OHIO.—The Canton Light, Heat & Lighting Company and the Central Heating & Lighting Company have been consolidated under the name of the Canton Electric Company. The company is capitalized at $2,500,000.

COLUMBUS, OHIO.—The Board of Public Service has placed an order with the Westinghouse Electric & Manufacturing Company for 300 arc lamps at a cost of $5,970.

CRIDERSVILLE, OHIO.—The Village Council has sold the electric light plant and a five acre tract, including several factory buildings to Lima capitalists connected with the Fort Wayne, Van Wert & Lima Traction Company, the highest bidder. The village had donated several thousand dollars to the factory, secured by a mortgage, and was compelled to foreclose, thus becoming temporary owner of the plant.

NEW PHILADELPHIA, OHIO.—The Tuscarawas County Electric Light & Power Company has been incorporated, with a capital stock of $200,000, by W. E. Fox, Henry S. Irving, S. D. Gilbert, Hiram D. Peck and Frank H. Shaffer, of Cincinnati. The company has purchased the plant of the A. Beyer Electric Company, which furnishes electricity for light and power in New Philadelphia and Canal Dover, and will make extensive alterations. The purchase price is $200,000.

PAINESVILLE, OHIO.—Bids will be received by the Board of Public Service until May 22 for furnishing machinery and equipment for the municipal electric light plant. Bids may be submitted as a whole or separately on the following: One steam engine of 150 horse-power; two return tubular boilers, and all necessary auxiliary apparatus, including steel stack; one direct-connected alternating-current dynamo of 100-kw capacity, with transformers, switchboards and all necessary apparatus for operation of the same; one belt-connected alternating-current 75-kw generator; 100 enclosed alternating-current arc lamps, with privilege of 25 additional. Engines of the fuel oil and producer gas types will also be considered. Plans and specifications may be secured upon application to W. N. Collister, superintendent of the plant.

TOLEDO, OHIO.—The Central Union Telephone Company has awarded the contract for the erection of its new building on Hicks Street to W. W. Bright. The building will cost about $30,000.

PORTLAND, ORE.—Bids will soon be opened by the officials of the Mount Hood Railway & Power Company for equipping the large power house that is to be built at Bull Run. The initial installation will be 15,000 horse-power, and it is expected to have the plant in operation by next winter.

SALEM, ORE.—The Portland General Electric Company has plans prepared for the construction of a concrete, brick and steel building adjoining its present steam plant on Mill Street. The building will be a one-story structure and will be designed to receive the power coming from Portland at 60,000 volts and from Silverton at 20,000 volts. The estimated cost of the building is about $10,000, and the machinery about $25,000.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company is installing a 1000-kw rotary converter, at Willow Grove, for the purpose of increasing the lighting facilities of Willow Grove Park.

PHILADELPHIA, PA.—Bids will be received by Col. Frank Heath, commanding Frankfort Arsenal until June 14 for one 350-kw dynamo direct connected to engine or turbine; boiler and condensing apparatus.

WASHINGTON, PA.—Application for a charter has been made by the Waynesburg & Monongahela Street Railway Company for the purpose of building an electric railway from Waynesburg to Millsboro. S. Crago, of Waynesburg, and R. H. Myers, of Washington, are interested in the project.

WILKES-BARRE, PA.—The Lackawanna & Wyoming Valley Railway Company is contemplating an expenditure of about $65,000 in improvements to its system.

YORK HAVEN, PA.—The stockholders of the York Haven Water & Power Company have voted to increase the capital stock of the company from $2,500,000 to $4,000,000, the proceeds to be used to increase the capacity of the plant by 10,000 hp, extending another cable across the river, and dredging to a distance of almost five miles above the plant. The company has recently contracted to furnish 1500 horse-power to the Pennsylvania Steel Works at Steelton.

BENNETTSVILLE, S. C.—Application has been made to the City Council by J. J. Matheson, Warren Moore and Vann Livingston for a franchise to build and operate a street railway in this place.

GREENWOOD, S. C.—Electricity for operating the municipal electric lighting plant is now being received from the Savannah River Power Company's plant on Seneca River. A day service has been established and many small enterprises are using electric motors for power purposes.

CARTHAGE, TENN.—The City Council has passed an ordinance for the construction of an electric light plant in this city.

FORT SAM HOUSTON, TEX.—Bids will be received until June 1 by L. J. Fleming, constructing quartermaster, U. S. A., for furnishing and installing electric light fixtures in the following buildings: Post exchange and gymnasium, post hospital, officers' club and two double stable guard and shop buildings; furnishing pole lines and making service connections to all the buildings mentioned above.

HOUSTON, TEX.—The Houston Light & Power Company is contemplating extensive improvements to its plant which will involve an expenditure of about $500,000.

HOUSTON, TEX.—The Southwestern Telephone Company has decided to build two new branch exchanges in this city. The company plans to expend about $50,000 in extensions and improvements to its system in Houston.

HOUSTON HEIGHTS, TEX.—The Houston Heights Water & Light Company has decided to make improvements to its plant and purchase new machinery, which will involve an expenditure of about $35,000.

SALT LAKE CITY, UTAH.—Guy Sterling, of this city, has made application to the state engineer's office to appropriate water from the Colorado River for power purposes. The scheme involves the construction of a high masonry dam with pipe outlets to power house. About 100,000 horse-power will be developed.

BALLARD, WASH.—J. Murdoch, city clerk, writes that it is not proposed to construct a municipal electric light plant, as reported in our issue of April 27.

OLYMPIA, WASH.—Dr. Henry Waldo Coe, of Portland, Ore., is said to be planning the establishment of a large power plant on the Toutle River, Cowlitz County. J. F. Lilly is the engineer.

SEATTLE, WASH.—W. H. Bard, of Bard & Fenton, of this city, will shortly erect in or near the city a large plant for the manufacture of electrical machinery, appliances and supplies. The purpose of the Bard Electric Company is to manufacture all kinds of electrical supplies for the Pacific Coast and the Orient.

SEATTLE, WASH.—Bids are being received by the Board of Public Works for supply of equipment to double the capacity of the city lighting plant at a cost of about $30,000. The apparatus will consist of two 8000-hp turbines or impulse water wheels; two 4000-kw, 2300-35,000-volt transformers for the generating station and eight 54,000-2500-volt transformers for the sub-station.

LA CROSSE, WIS.—The La Crosse City Railway Company has increased its capital stock to $250,000. It is understood that extensive improvements are to be made and that additional machinery is to be purchased.

MILWAUKEE, WIS.—The Plankinton Electric Light & Power Company has been granted a franchise by the City Council to construct tunnels in the Fourth Ward.

OSHKOSH, WIS.—The Northern Hydro-Electric Company has been organized at Oshkosh, Wis., with a capital of $2,000,000. The new company proposes to develop the power of the Peshtigo River, which empties into Green Bay half-way between Lake Michigan and the mouth of the Fox River. It has secured three waterfalls on which dams will be erected. About 20,000 horse-power will be developed and trnsmitted to Marinette, Menominee, Green Bay and possibly to Oshkosh.

WITTENBERG, WIS.—The Wittenberg Independent Telephone exchange has been purchased by J. Eckhon & Son, who will extend the toll lines.

CHEYENNE, WYO.—It is announced that plans have been received for the erection of a $1,000,000 power plant for the Northern Colorado Power Company, in this city, and that work on the construction of the plant will begin within two weeks.

CALGARY, ALB.—The plans which are being prepared for the street railway to be built here at a cost of $250,000 will be completed by August 1, and tenders will then be called as soon as possible. Address City Engineer Thorold.

EDMONTON, ALB.—On May 27 the ratepayers will vote on the following money by-laws: Power house site, $26,000; electric light and power plant, $120,000. Address Mayor Griesbach.

BRANDON, MAN.—The City Council is considering a proposition to develop electrical power at Currie's Landing. An electrical engineer has been engaged to report on the matter.

HAMILTON, ONT.—The City Council is considering a proposition to build a municipal street railway system at a cost of $500,000. Address S. H. Kent, Hamilton, Ont.

NIAGARA FALLS, ONT.—A contract has been closed between the Canadian Government, represented by the Hydro-Electric Power Commission and the Ontario Power Company, whereby the latter company, situated at Niagara Falls, Ont., is to supply between 25,000 and 100,000 horse-power 24 hours daily to Canadian municipalities for a period of ten years. The Canadian government will supply the transmission lines, and government bonds will be issued to raise money for this construction work. Fourteen Canadian cities in Ontario have filed application thus far for power, aggregating about 40,000 horse-power. The government will pay $10.40 per horse-power per year up to 25,000 horse-power, and for any quantity in excess of that amount a flat rate of $10 delivered at the transformer station at Niagara Falls, Ont., and will sell this power at cost to the municipalities which will have charge of the distribution.

TORONTO, ONT.—The R. Simpson Company has increased its capital from $1,000,000 to $2,500,000, and has been given rights to develop electrical power for its own use.

ROULEAU, SASK.—The Council is considering the installation of an electric power plant. Address A. C. McKean.

FORT SASKATCHEWAN, SASK.—The electric lighting system here owned by O. Higman has been sold to a local syndicate formed under the name of the Fort Electric Company.

CHALCO, MEX.—Inigo Noriega, of Mexico City, has been granted a concession by the Mexican government to build an electric railway from Mexico City to the town of Chalco, a distance of about 20 miles.

CULIACAN, MEX.—J. C. Avendano, of Mexico City, has made application to the Mexican government for a concession to install a hydro-electric plant on the Humaya River, district of Culiacan, state of Sinaloa. The power will probably be transmitted to Culiacan and other towns of that section.

JALISCO, MEX.—Frank G. Stevens, who is connected with the Favor Mining Company, has made application to the Mexican government on behalf of that company for a concession to install a hydro-electric plant on the Santiago River in the state of Jalisco.

REAL ALTO, MEX.—Makeever Brothers, of New York, N. Y., are preparing to install a hydro-electric plant with a capacity of 1000 horse-power at Real Alto, state of Jalisco. The plant will be located on the Los Reyes River and will furnish electricity for the mines owned by the Makeever Brothers in that district.

TORREON, MEX.—The Lerdo & Torreon Electric Railway Company is arranging to make important extensions to its present system in Torreon. A concession for another electric railway system in Torreon was recently granted to a syndicate of Chinese residents. The latter are preparing to begin construction work.

TUXPAM, MEX.—Carlos F. de Landero, manager of the Bank of Hidalgo, of Pueblo, is organizing a company for the purpose of installing a hydro-electric plant on the Tuxpam River, near the town of Tuxpam, state of Jalisco. It is estimated that 15,000 horse-power can be developed. It is proposed to transmit electricity to Tuxpam, Colima, Manzanillo and a number of other towns and industrial centers of that region. In addition to installing this hydro-electric plant, Mr. Landero has purchased the Rio Blanco Falls on the San Isadro ranch, near Guadalajara. He states that these falls will be taken over by the company which he is forming and a hydro-electric plant installed there for the purpose of furnishing the city of Guadalajara and the town of Zapopan with electricity for light and power. This second plant will have a capacity of about 1500 horse-power.

New Industrial Companies.

THE BELL ELECTRIC MOTOR COMPANY, of Jersey City, N. J., has been chartered, with a capital stock of $25,000. The incorporators are: Robert J. Stell, Andrew C. Snyder and Abraham L. McCulloch.

THE BROWN ELECTRICAL COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $500, by Hyman Brown, Eva Brown and Abraham Bernstein.

THE INTERNATIONAL ELECTRIC COMPANY, of St. Louis, Mo., has filed articles of incorporation, with a capital stock of $100,000. The object of the corporation is to manufacture and deal in electrical appliances. The incorporators are: Wm. F. Gradolph, Clara A. Niel, Joseph Zerr, Mason K. Blake and E. A. Wiedermann.

THE KING MANUFACTURING COMPANY, of Indianapolis, Ind., has been incorporated to manufacture a patented rotary engine. The capital is $50,000. The officers are: D. W. Bolen, president; W. F. King, secretary, and J. M. King, general superintendent.

THE NEW YORK CAHILL TELHARMONIC COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $500,000, for the purpose of distributing music electrically and to own lines for that purpose. The directors are: Oscar T. Crosby, Warrentown, Pa.; O. C. Reynolds and A. B. Twiggs, of Tileston, N. Y.

THE TELEPHONE CALL RECORDER COMPANY, of New York, N. Y., has been chartered, with a capital stock of $50,000, by J. H. Thompson, W. H. Fulton, of Plainfield, N. J., and R. D. Lampson, of New York.

THE WEINSHEIMER COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $5,000. The company proposes to do an electrical engineering and construction business. The incorporators are: Warren E. Weinsheimer, E. W. Switser and P. R. Fisher.

New Incorporations.

BIRMINGHAM, ALA.—Articles of incorporation have been filed for the Burney Electric Company, with a capital stock of $3,500, by C. W. Burney and others.

OURAY, COL.—The Colorado-Wyoming Electric Company has been organized under the laws of Nevada to own and operate electric light and power properties at Ouray, Col., and Laramie, Wyo. The company is capitalized at $350,000, and the officers are: J. A. Arbogast, of Akron, Ohio; E. A. Phinney, Ouray, secretary, and G. A. Scott, Ouray, treasurer. The Ouray Electric Power & Light Company has absorbed the Laramie Light & Power Company, of Laramie, Wyo., and both companies are now controlled by the Colorado-Wyoming Electric Company, the officers of all three companies being the same throughout.

CHICAGO, ILL.—The Gunther Electric Company has been incorporated, with a capital stock of $175,000, for the purpose of operating heat, light and power plants. The incorporators are: Charles F. Gunther, Burrell Gunther, Donald R. Richburg and others.

BLOOMINGTON, IND.—The Central Indiana Light & Heating Company has been incorporated, with a capital stock of $3,000,000. The company will carry on a business in the manufacture and installation of electric light, power and heating plants. The directors are: William Wherry, John W. Forbin and I. L. Melloon, all of New York.

SOUTH BEND, IND.—The Indiana & Michigan Electric Company has been incorporated, with a capital stock of $1,915,000. The company proposes to generate and sell electricity for light, heat and power purposes in South Bend, Mishawaka, Elkhart, Bristol, Goshen, Laporte and Michigan City, Ind., and in Niles, St. Joseph, Benton Harbor, and other towns in Michigan. The directors are: Charles A. Chapin, H. L. Crawford and others.

DAVENPORT, IA.—The Ideal Lighting Company has been incorporated, with a capital stock of $10,000, by S. T. White and others.

TOPEKA, KAN.—The Kansas City & Olathe Electric Railroad Company has been chartered with a capital stock of $175,000. The incorporators are: David B. Johnson, R. V. Larson, Georg Holsinger, James A. Stewart, E. P. Dickson and R. W. Hooker. The main office of the company is in Rosedale.

BALTIMORE, MD.—The Baltimore Telephone Company has been incorporated, with a capital stock of $1,000,000. It is understood that the company was formed to carry out certain plans of the Maryland Telephone & Telegraph Company. The incorporators are: William T. Spring, Robert F. Bonsall, William H. Martin, Edward P. Hill and Arthur Y. Pindell.

CALUMET, MICH.—Articles of incorporation have been filed for the Calumet Electric & Improvement Company with a capital stock of $100,000. The incorporators are John Daniell and others.

OMAHA, NEB.—The Electrical Service Company has been incorporated, with a capital stock of $50,000. The incorporators are: Henry T. Clarke and Henry T. Clarke, Jr.

CAMDEN, N. J.—The Hite Electric Company has been chartered with a capital stock of $1,000,000. The directors are R. Hansell, Philadelphia, Pa.; George H. B. Martin, and S. C. Seymour, Camden.

JERSEY CITY, N. J.—The Chenango Valley Electric Railway Company has been incorporated with a capital stock of $100,000 by H. O. Coughlan, L. H. Gunther and John R. Turner.

ROCHESTER, N. Y.—The Buffalo, Rochester & Eastern Railroad Company has filed articles of incorporation with the Secretary of State. The purpose of the company is to construct a railway to be operated by steam, electricity or gasoline from Buffalo to Rochester, and thence to Troy, a distance of 300 miles. The capital stock of the company is $3,500,000, and the directors are: Ralph D. Gillett, Westfield, Mass.; Arthur Eaton, Pittsfield, Mass.; Franklin Weston, Dalton, Mass.; Henry H. Bowman, Springfield, Mass., and James H. Caldwell, of Troy, N. Y.

SYRACUSE, N. Y.—The Syracuse & Chittenango Railway Company has been incorporated to operate an electric street railway from Syracuse to Chittenango, a distance of 18 miles. The capital stock of the company is $500,000 and the directors are W. H. Dowe; G. S. Terry, of New York, N. Y., and C. B. Everson, of Syracuse.

APEX, N. C.—The Apex Water Company has been chartered to construct and operate light, power and water plants. It has a capital stock of $25,000. C. P. Sellars, Percy Olive and associates, of Apex, are the incorporators.

SALISBURY, N. C.—The Piedmont Carolina Railway Company has been chartered, with a capital stock of $100,000, by T. H. Vanderford, W. F. Snider and J. H. Horah.

TRYON, N. C.—The Electric Light, Water & Power Company has been organized to establish an electric light plant in this place. The power house will be located near Melrose Mountain, on Pacolet River, about four miles above Tryon.

WILLIAMSON, N. C.—A charter has been granted to the Williamson Light & Power Company by the Secretary of State. The incorporators are: J. D. Biggs and others. The company is capitalized at $50,000.

WILSON, N. C.—The Dixie Light Company has been chartered, with a capital stock of $25,000, by J. R. Hardie and others.

CANTON, OHIO.—The Power Electric Company has been incorporated, with a capital stock of $100,000, by M. S. McKee and others.

NEW PHILADELPHIA, OHIO.—The Tuscarawas County Electric Light & Power Company has been incorporated with a capital stock of $20,000 by W. E. Fox and others.

OKLAHOMA CITY, OKLA.—A charter has been granted to the El Reno, Oklahoma City & Shawnee Railroad. The company has a capital stock of $2,500,000 and the incorporators are G. N. Martin, of Chicago, Ill.; S. P. McIntyre, of New York, N. Y.; Elmer E. Houghton, N. M. Ellis, and John H. Wright, of Oklahoma City.

TECUMSEH, OKLA.—The Tecumseh-Norman Traction Company, which was recently chartered, has been reorganized as the Oklahoma Rapid Transit Company with offices at Oklahoma City. The officers of the company are: George Silsby, president; W. E. Powell, vice-president; George Weed, secretary and D. D. Klapp, treasurer.

PORTLAND, ORE.—The Inland Electric Railroad Company has filed articles of incorporation, with a capital stock of $25,000, for the purpose of building an electric railway from Klamath Falls to Merrill. The incorporators are: E. J. Murray and H. L. Colgate.

COATESVILLE, PA.—Articles of incorporation have been filed for the Coatesville Supply, Light, Heat & Power Company by J. E. Shalleross and others. The capital stock of the company is $5,000.

JEFFERSON CITY, TENN.—Articles of incorporation have been filed for the Jefferson City Electric Railway, Light & Power Company by W. T. Russell, J. B. Huff, A. A. Galbraith, J. T. Watkins and Frank Galbraith. The company is capitalized at $15,000.

EL PASO, TEX.—Articles of incorporation have been filed for the El Paso Suburban Railway Company with a capital stock of $10,000 by F. R. Tobin, J. D. Tobin and W. Camp.

SPRING VALLEY, WIS.—The Spring Valley Light & Power Company has been incorporated, with a capital stock of $15,000, by Otto Sieberus and others.

Legal.

CONTRACT FOR SERVICES WITH PROVISION THAT INVENTIONS OF EMPLOYEE SHOULD BECOME PROPERTY OF EMPLOYER.—The defendant, a draughtsman, wrote to the plaintiff, a corporation engaged in manufacturing, devising and selling machinery, particularly for saw mills, soliciting employment in his line of work. The defendant, in one of his letters, agreed to work for a certain stipulated sum per month and, in consideration therefor, he consented that any improvements he might make should be the property of the plaintiff and agreed to assign to the plaintiff any inventions he might make during the course of his employment. The defendant, while in the plaintiff's employ,

made certain inventions and applied for patents without the plaintiff's knowledge. In an action brought by the plaintiff to require specific performance of his contract by the defendant a decree was granted directing the defendant to assign to the plaintiff the inventions which he had made, upon the payment of the expenses which he had incurred in making application and procuring the patents. Portland Iron Works vs. Willett, Supreme Court of Oregon, 89 Pac. Rep. 421.

DUTY OF EMPLOYER TO FURNISH SAFE MACHINERY AND APPLIANCES.—Where a motorman in charge of an electric car, is injured by the breaking of air brake apparatus on the car, due to a flaw or defect in the brake rod, the employer is ordinarily liable in damages to the motorman under the rule that it is the legal duty of the former to exercise ordinary care to furnish or provide machinery and appliances reasonably safe and suitable for the employees to perform their duties. But, in order to hold the employer responsible, it must appear that he was chargeable with knowledge, either actual or constructive, in respect to the defective appliance and that he thereafter permitted it to be used in the operation of the car. In this instance a judgment in favor of the plaintiff was reversed on the ground that he did not aver that sufficient time intervened between the time when the defendant became aware of the defective condition of the brake rod and the time of the accident to allow the rod to be repaired. Kentucky & Indiana Bridge & R. Co. vs. Morgan, Supreme Court of Indiana, 80 N. E. Rep. 536.

INFRINGEMENT OF PATENTS FOR ELEVATOR SIGNALING APPARATUS.—The Elevator Supply & Repair Company has been upheld by the United States Circuit Court, S. D. New York, in an action to restrain an infringement of the following patents relating to electric signaling apparatus for use on elevators: The C. G. Armstrong patent, No. 499,411, dated June 13, 1893; the Stacy B. Opdyke, Jr., patent, No. 572,561, Dec. 8, 1906, and the Charles A. Reiners patent, No. 634,220. The alleged infringing device was installed in the Presbyterian Building, 156 Fifth Avenue, New York City. On each floor was a single push-button box having an up push-button and a down push-button and above the doorway of each shaft, an up incandescent floor light and a down incandescent floor light. The push buttons were connected with signal lights within the elevator cars, which were lighted upon pushing the proper button. After the car had passed the floor from which the signal was given a restoring circuit was automatically closed, thus energizing a restoring magnet in the push-button box, and permitting the push-button switch to snap out and break the circuits. The patents owned by the complainant were held to be valid and the device in use by the defendant were declared to be an infringement thereof. Elevator Supply & Repair Company, 151 Fed. Rep. 497.

THEFT OF ELECTRICAL GOODS.—The manufacturing and jobbing trade generally will be interested to learn of the success that has attended the prosecution of Ralph Lipsey, former president of the Great Northern Metal Company, and second-hand dealer, of Chicago, whose conviction for receiving stolen property has just been affirmed by the Supreme Court of Illinois; and also of the plea of guilty made by Arthur Dietrickstein, held under a charge of larceny and of his imprisonment on the plea. These two cases against Lipsey and Dietrickstein arose by reason of the fact that they conspired together and succeeded in stealing several cases of electrical sockets from one of the large Chicago jobbers. Dietrickstein stole the goods and sold them to Lipsey, who acted as the fence. These prosecutions have resulted in putting Lipsey entirely out of business and thus removing a constant menace to the Chicago trade, as a second-hand dealer acting as a fence and receiving stolen property simply made it possible for the looting of the electrical stores to be successfully pulled off, and the goods profitably disposed of by the thieves, through such channels as the institution that Lipsey conducted. The cases against both Lipsey and Dietrickstein were worked up by Frederic P. Vose, Esq., counsel for the National Electrical Trades Association, and attorney for many of the electrical manufacturers and jobbers, and the matter was handled by Assistant State's Attorney James J. Barbour, whose work in the trial of the cases resulted in conviction.

RIGHT OF CITY TO COMPEL REMOVAL OF ELECTRIC SIGN SUSPENDED OVER SIDEWALK.—In an action by the City of St. Louis to recover $500 from a theatre company for the violation of an ordinance of the city making it a misdemeanor to erect or maintain a sign over any of the sidewalks of the city, extending more than eighteen inches from the building to which it was attached. The defendants had erected an electrically illuminated sign in front of the theatre but the sign was in position before the ordinance in question went into effect. And it was contended that, as there was no ordinance prohibiting the erection of such a sign at the time it was put up, and as the sign was erected lawfully and at considerable expense, the defendants had a vested property right which could not be taken away from them. But it was held that it does not follow that, because a municipality has not, by ordinance, prohibited a certain thing, in the exercise of its police or other powers, it can, at no time prohibit such things. In the growth of cities the public convenience and welfare may demand restrictions as to the use of streets by abutting owners, which in the earlier life of the city was not demanded; but it does not follow from this that the earlier use cannot be prohibited at such later time as the public interest requires it. If a municipality, by express grant, authorizes an invasion of a public street, and such invasion does not seriously injure and infringe upon the public use thereof, then such municipality might not be allowed, by subsequent ordinance, to divest the party, who has acted upon the express grant, of the rights which have accrued thereunder. But such was not the case at bar. It was also held that the ordinance was reasonable and that the defendants could not attack its validity upon that ground. City of St. Louis vs. St. Louis Theatre Company, Supreme Court of Missouri, 100 S. W. Rep. 627.

RIGHTS OF TELEPHONE COMPANY UNDER FRANCHISE.—The city of Salem, Oregon, granted a franchise to the Pacific States Telephone Company to erect a telephone system in the streets and thoroughfares of the city, with wires above or under ground as the company might elect, in consideration of which the city was to be allowed to use the poles and conduits free for fire alarm purposes and the city officers and municipal fire department were to have telephones for their use without charge. Later a dispute arose and to settle the matter the telephone company agreed to pay the city the sum of $200 annually for a term of ten years during which time the city promised not to grant a franchise to any other telephone company upon terms more favorable than those of the Pacific States Company's franchise. Before the expiration of the ten years the city granted a franchise for a term of twenty-five years to another company. It was required of the new company that all of its wires be placed under ground, that, after the first year, one per cent of the gross annual receipts of the company should be paid to the city and that the company should furnish and keep in repair five instruments for the city's use. It was to restrain any action under the new franchise that the Pacific States Company brought an action upon the ground that the new franchise was more liberal in its terms than its own franchise and, therefore, in violation of the contract referred to which the city made with the Pacific States Company. It was held that the two franchises differed so essentially that to determine which of them offered the greater advantages would amount to mere speculation. The burden of establishing that the new franchise was the more desirable rested upon the plaintiff and, as it did not successfully shoulder that burden, it was held that no relief could be granted. Pacific States Telephone Company vs. City of Salem, Supreme Court of Oregon, 89 Pac. Rep. 145.

Obituary.

Mr. W. FOLOCKEMER, president of the Lafayette, Ind., Telephone Company, and a director of the American National Bank, died recently at Lafayette, aged 81 years. He had been ill for some time.

MR. F. C. BARR.—We regret to note the death, at Denver, Col., on May 9 of Mr. F. C. Barr, electrical engineer of the Colorado Telephone Company. The deceased was well known in the telephone field and was regarded as one of the best engineers in the Bell Telephone organization. He had been a member of the American Institute of Electrical Engineers since 1903. Their loss is deeply regretted by his colleagues in the Colorado Telephone Company.

Personal.

MR. RICHARD EYRE has become a member of the firm of Kenyon & Kenyon, the well known patent lawyers, of 49 Wall Street, New York City.

MR. F. HOUGHTON, of the Cleveland Electric Illuminating Company, on May 1 read a paper on "Electric Power Transmission in Factories" before the Cleveland Electric Club.

MR. FRANK C. BRACELIN has been appointed manager of the Crookston district of the Northwestern Telephone Company. Mr. Bracelin will have his headquarters in Crookston.

MR. BENJAMIN MAGNUS has been appointed manager of the Electrolytic Refinery & Smelting Company, of Australia, Limited, with address at Pitt Street, Sydney, Australia.

MR. B. W. MENDENHALL has resigned as commercial engineer of the Utah Light & Railway Company to accept a position as manager of the Ely Light & Power Company, Ely, Nevada.

MR. G. W. JOHNSTON, electrical engineer of the Southern Railway System, having completed all heavy construction work and the reorganization of the electrical department of the company, has resigned.

MR. ANDREW PINKERTON, formerly secretary of the Power Improvement Company, Milwaukee, has opened an office in the Farmers' Bank Building, Pittsburg, for the practice of consulting electrical and mechanical engineering.

MR. E. E. MILLER, manager of the new business department of the Cincinnati Gas and Electric Company for several years, and with the Union Gas and Electric Company, has resigned, and with his family will spend the summer in Europe.

MR. P. J. KRUESI, manager of the American Lava Company, Chattanooga, Tenn., has been making a round of visits in the East and North and returned home on May 13. He reports the demand for insulating material excellent, with a recent marked revival in business.

PROF. ELIHU THOMSON lectured recently at Lynn, Mass., before the Twentieth Century Club on the Panama Canal, which he visited this winter. He believes in a lock canal and predicts completion in about eight years. The lecture was illustrated with stereopticon slides.

Mr. C. W. E. CLARKE has resigned his position as assistant engineer with Sargent & Lundy, of Chicago, with whom he has been connected for the past five years, and has accepted the appointment of steam engineer in the electrical department of the New York Central Railroad, at New York City.

MR. P. E. HART, Port Arthur, Ont., writes that the statement in our issue of April 27 that he had been appointed superintendent of telephones and electric lighting at Kenora, Ont., is an error. The position was offered to him but he declined it, preferring to remain with the Allis-Chalmers-Bullock Company.

MR. C. B. GOING.—Mr. Charles Buxton Going, editor of the *Engineering Magazine*, who has for several years contributed poems to the magazines, will appear in the June *Scribner* as a writer of fiction. His story, entitled "Off the Track," is an episode in the life of an engineer engaged in the work at Panama.

MR. BION J. ARNOLD.—Note was made in these pages last week of the extraordinary accident to Mr. Arnold, through which he bit off his tongue. Mr. Arnold telegraphs us from Chicago that the press dispatches described the incident accurately; but he hopes to be able to talk again in two weeks if everything continues to go as well as at present.

CHARLES H. GLASSER, formerly mechanical engineer of The Camel Company, Chicago, has accepted a position with the American Steam Gauge & Valve Mfg. Company, and will make his headquarters at its Chicago office. Mr. Glasser has had several years' experience in the mechanical field and has a very wide acquaintance.

MISS E. M. HAWKINS.—The Stevens Institute of Technology has appointed Miss E. M. Hawkins, graduate of the Pratt Institute Library School, to take charge of its library. An important feature of the library is that section devoted to patent literature, containing the patent gazettes and specifications. Prof. W. H. Bristol, so well known in the field of instruction, has contributed liberally to the support of this section.

MR. T. W. GOODRIDGE.—In order to take up an independent manufacturing proposition not unrelated to the motor car industry, Mr. T. W. Goodridge, for the past five years general manager of the Studebaker Automobile Company, South Bend, Ind., has resigned. He will not, however, leave his present position until considerably later in the selling season. Mr. Goodridge has a wide circle of acquaintance in the mechanical and electrical fields.

MR. F. STEINHART.—It is stated from Havana that Consul General Frank Steinhart, who resigned three months ago, will become manager of the Havana Electric Railway. His resignation as Consul General takes effect June 1. Mr. Steinhart came to New York in March as the representative of large stockholding interests for the annual meeting of the Havana Electric Railway, at which it was expected that a fight would be made to oust the present management. He was then elected to the directorate.

MR. W. Y. LEWIS has resigned his position as mechanical and electrical engineer with S. Pearson & Son, contractors on the construction of the P., N. Y., & L. I. R.R. East River tunnels, New York, having been appointed manager of the erecting department of the International Steam Pump Company, New York City. While with S. Pearson & Son, Mr. Lewis was engaged on the installation of the very extensive air compressing hydraulic, and electric plants for the operation of the East River tunnel.

MR. F. P. FISH.—The recent retirement of Mr. Fish from the important presidency of the American Telephone & Telegraph Company has created considerable interest as to his plans for the future. It is now announced that a partnership firm has been formed for the general practice of the law under the name of Fish, Richardson, Herrick & Neave, which will have its offices at 84 State Street, Boston, and 5 Nassau Street, New York. The members of the firm are Messrs. F. P. Fish, W. K. Richardson, Robert F. Herrick, Charles Neave, Guy Cunningham, A. D. Salinger, Jeremiah Smith, Jr., J. L. Stackpole and Malcolm Dould. Mr. Fish does not withdraw entirely from the business field, but will retain a number of directorships.

DR. A. T. HADLEY.—It is announced that President Hadley of Yale University will go to Berlin immediately after the meeting of the Yale University Corporation next October, to fill the Theodore Roosevelt Professorship of American History and Institutions at the University of Berlin. He will return in time for the meeting of the Yale Corporation, in March, 1908, thus being absent about five months. The subject of the public lectures of President Hadley will be "The Question of Industrial Policy in the United States," and the subject of his classroom work will be "Exercises in American Industrial History." The professorship is endowed with $50,000 raised in this country, and nomination to it is made by the Trustees of Columbia University, New York City, with confirmation by the Prussian Ministry of Education. President Hadley will deliver the lectures in the German language.

MR. CLARENCE H. MACKAY, president of the Postal Telegraph & Cable Company, recently visited the coast and in regard to new work for his company stated: "We have decided to build a telegraph line from Salt Lake directly westward to Ely and Manhattan and Tonopah and Goldfield and to Ludlow, in Nevada, and a line through from Reno to San Francisco. We shall also string extra wires from Salt Lake eastward to New York, and from San Francisco southward to Los Angeles. We intend to establish a comprehensive and augmented service. We have leased from the Crocker Estate for San Francisco offices for the Postal Telegraph, the Commercial and the Pacific Cable Companies part of a ten-story Class A building soon to be erected by the Crocker Estate at the northeast corner of Bush and Battery Streets. The building is to be completed in about 18 months, and we are to have part of the ground floor, half of the ninth floor and all of the tenth floor." A new permanent building is to be erected on the beach for the terminus of the Commercial Cable Company's Pacific cable.

Trade Publications.

CONVEYING MACHINERY.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued as Catalogue No. 57B an illustrated bulletin containing reproductions from photographs showing its conveying machinery in operation in saw mills, lumber mills and wood working industries.

VACUUM PUMPS.—The Pulsometer Engineering Company, Limited, Reading, England, has issued a folder dealing with the "Geryk" vacuum pump. It is stated that this pump is well adapted for use in lamp factories, its rapidity of exhaustion being 60 times as great as that of the Sprengel and many times larger than any mercury pump.

STEAM SPECIALTIES.—The 1907 catalogue of the Ashcroft Manufacturing Company, 85 Liberty Street, New York, gives a brief but complete description of the various specialties, instruments and tools manufactured by this company, including steam, pressure and vacuum gauges, recording gauges, steam engine indicators and a general line of engineering instruments, pipe stocks and dies, pipe tongs and ratchets.

MOTOR LATHES.—The Victor Electric Company, 55 Market Street, Chicago, Ill., has issued Bulletin No. 27, dealing with motor lathes for dentist's and jeweler's uses, and for machine shops. The motors are of either the direct-current or alternating-current type and range in rating from .125-hp to .20-hp. Bulletin No. 25, of the same company, is devoted to small belted type direct-current motors.

WESTERN ELECTRIC COMPANY has issued a handsome catalogue of its 1907 fan motors. The types shown embody all the good features of the 1906 models, as well as a number of new points in design and construction, all tending to economy and efficiency. The pamphlet includes the Hawthorne motors for direct-current circuits, the Westinghouse and Tuerk alternating types, ceiling fans, ventilating outfits, etc.

POLARITY INDICATOR.—A folder issued by J. H. Gravel, 1005 Drexel Building, Philadelphia, Pa., describes a chemical polarity indicator which is stated to possess many advantageous characteristics. The indicator consists of a sheet of chemically treated paper which is moistened and applied to the circuit; a red spot appears at the negative pole.

CEILING FANS.—The Hunter Fan & Motor Company, Fulton, N. Y., has issued an extremely attractive catalogue dealing with the Tuerk alternating-current ceiling fans. Each page on which technical description is given contains also a pen sketch of some familiar locality where ceiling fans are used to advantage. The illustrations of the fan equipments are tastily arranged in black and gold with a half-tone gray background.

ELECTRIC MINE LOCOMOTIVES.—A valuable engineering treatise on electric mine haulage has been issued by the General Electric Company as Bulletin No. 4468. The bulletin is not a "catalogue" as such term is usually applied, but is a well-prepared, profusely-illustrated discussion of the problems encountered in mine haulage, with much information relating to the methods by which the problems may be and have been solved, with valuable data as to the results obtained.

STURTEVANT SETS.—By the issue of Bulletin No. 143, entitled "Generating Sets with Horizontal Engines," the B. F. Sturtevant Company, Hyde Park, Mass., completes its group of publications in its Engineering Series relating to engines and generating sets. These now comprise one bulletin each covering the following subjects: Vertical enclosed engines, horizontal center crank engines, vertical compound enclosed engines, and one bulletin each descriptive of generating sets equipped respectively with each of the above types of engines.

Business Notes.

THE WHITING FOUNDRY EQUIPMENT COMPANY, Harvey, Ill. (Chicago suburb), manufacturer of cranes and foundry equipment, announces the appointment of a new Southern representative, H. W. Canning, with headquarters in the Brown-Marx Building, Birmingham, Ala.

B. F. STURTEVANT COMPANY.—The New York office of the B. F. Sturtevant Company has just been removed from 131 Liberty Street to the Engineering Building at 114 Liberty Street, where much better facilities will be provided for conducting the rapidly increasing business of this well-known company. The past year in particular has marked a rapid advance in the installation of Sturtevant apparatus in New York and vicinity.

JAMESTOWN EXPOSITION.—The National Electrical Supply Company, of Washington, D. C., made a handsome gold push button to be used by President Roosevent on April 26 in opening the Jamestown Exposition and starting the machinery. It contains 50 pennyweight of gold and is set in a sumptuous case. President Graham, of the company, is very proud of the job.

UNITED BRASS MFG. CO.—In our issue for May 4, on page 914, the name of the maker of the cable splicing machine there described was given as Ohio Brass Mfg. Co., while it should have been United Brass Mfg. Co., Cleveland, Ohio. Although the wipe-joint machine is comparatively new, it has been in successful service for several months, and we have been informed that the sales are increasing at a very satisfactory rate.

THE ALLISON, CAMPION, McCLELLAN COMPANY has been organized by Messrs. H. T. Campion, Wm. McClellan and H. N. Twells as successors to the John W. Allison Company, to engage in engineering

work. The company states that it is prepared to carry a project through the periods of design, construction and successful operation. The offices of the company are at 905 West Street Building, New York, and 1628 Land Title Building, Philadelphia.

CARNEGIE INSTITUTE LIGHTING.—I. P. Frink, 551 Pearl Street, New York City, furnished for the new art gallery of the Carnegie Institute, Pittsburgh, about 2600 of the Frink special art gallery reflectors. The firm supplied the fixtures for the original galleries and although nearly all other forms of art gallery lighting were presented to the engineers and the architects for their consideration, the contract went as above noted.

J. H. HALLBERG, 30 Greenwich Avenue, New York, is now devoting part of his time to the design and manufacture of flaming arc lamps and other electrical specialties. As this addition to his regular engineering business necessitated the co-operation of a factory, he has moved from 45 Broadway to 30 Greenwich Avenue, New York City, where he occupies offices with the Beck Flaming Lamp Company, acting as engineer and general manager, but retaining his old clients and continuing to do a general consulting engineering business.

GREEN FUEL ECONOMIZER.—The New York branch of the Green Fuel Economizer Company has removed to the new West Street Building, No. 90 West Street. The new offices will be considerably larger than the old, in order to take care of the increasing business in economizers, fans, blowers and exhausters. Since entering the fan business, this company has built many large fans for mechanical draft, including several with over-hung wheels, larger than any of this type ever built before. The New York representative is Mr. William Downs.

ROBBINS & MYERS CO.—Owing to the very rapid increase of its Eastern business in the power motor and fan motor line, the Robbins & Myers Co., whose main office and factory are located in Springfield, Ohio, has recently moved its New York office and salesroom from 66 Cortlandt Street, to 145 Chambers Street, where it occupies a five-story building. This new location provides splendid facilities for carrying a larger stock and making prompter deliveries. The New York office will henceforth also look after all the New England trade and make deliveries from the New York stock.

THE WESTERN ELECTRIC COMPANY, starting the first of the present year, entirely reorganized its advertising department, placing it in charge of Mr. Howard M. Post, who had previously successfully handled the advertising for the Kellogg Switchboard and Supply Company, manufacturers of telephone apparatus, and for the Quincy-Manchester-Sargent Company, manufacturers of railroad supplies and machinery. Mr. Post was also associated with the Lord & Thomas Company for some time. It is understood that Mr. Post is instituting numerous new systems in advertising, such as have never been utilized before by that company, and that their results so far are highly satisfactory.

VOLTAX LIQUID COMPOUND, which, for the past year, has been coming into extensive use as a weatherproof paint, has just been specified by the Board of Education of New York City as a standard paint in Section 70, relating to painting and enamelling on screens, radiators, coils and connections. Voltax will be used as a paint on pneumatic pipes, valves, canvas coverings on smoke pipes, grease extractors, economizer connections, feed water heaters, receiving tanks, boiler and incinerator fronts and on all fixtures, boilers, engines, pumps, blowers, foundations, steel bands and tanks set in the floors. To meet the rapidly growing demands for the Voltax compound, the Electric Cable Company, of 17 Battery Place, New York City, is now erecting an extensive addition to its plant at Bridgeport, Conn.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED MAY 7, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

852,424. SECONDARY BATTERY; Thomas A. Edison, Llewelyn Park, Orange, N. J. App. filed Nov. 28, 1902. In a storage battery, a rectangular receptacle or can one or more of whose walls are provided with panels of transverse corrugations entirely surrounded by plane metal, substantially as set forth.

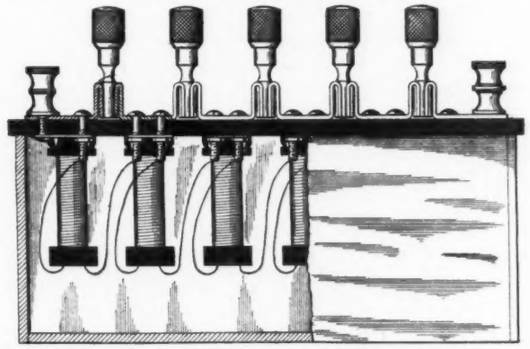
852,431. JUNCTION BOX; Edwin T. Greenfield, Kiamecha, N. Y. App. filed Dec. 29, 1905. A form of bushing threaded to be received in an outlet box, is adapted to engage a pair of split wedges which bind upon the cable passing through the bushing.

852,464. STORAGE BATTERY; Edward Sokal, Binghamton, N. Y. App. filed May 4, 1906. A storage battery comprising a porous storage battery electrode, and means operating to forcibly circulate or push a storage battery electrolyte through the pores of said electrode from one side to the other side thereof, substantially as set forth.

852,468. MOTOR CONTROLLER; Emmett W. Stull, Norwood, Ohio. App. filed July 30, 1906. A form of controller having a plurality of drums with segments geared together and arranged so that the "full on" position of the controller may correspond to different speeds for city and suburban traffic respectively.

852,484. TELEGRAPHIC SAFETY DEVICE; Selden R. Wright, Morton, N. Y. App. filed Aug. 7, 1903. A telegraphic safety device of the type having clockwork mechanism for closing the main line circuit after a predetermined time in case it is left open.

852,489. CLUSTER LAMP SOCKET; Reuben B. Benjamin, Chicago, Ill. App. filed Jan. 31, 1903. Cylindrical lamp receptacle having two sockets on diametrically opposite sides with coincident axes.



852,536.—Resistance Box for Electrical Measurements.

852,490. TWIN LAMP SOCKET; Reuben B. Benjamin, Chicago, Ill. App. filed Feb. 29, 1904. Relates to modifications of the above.

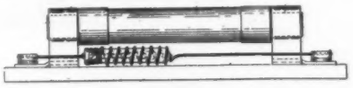
852,491. PLURAL LAMP SOCKET; Reuben B. Benjamin, Chicago, Ill. App. filed Oct. 1, 1904. Additional modifications.

852,495. MULTIPLEX TELEGRAPHY; John Burry, Ridgefield Park, N. J. App. filed Jan. 21, 1905. The signals are produced by intermittent or pulsating currents of a given hitch or tone which are transmitted over the line and received in a telephone receiver. The operator gets the message in a special code having different musical tone combinations as its basis.

852,502. SIGNALING SYSTEM; Eugene Garretson, Buffalo, N. Y. App. filed July 17, 1905. A signalling system employing inductively derived currents. Has a source of energy and a transformer and a quick acting non-continuity preserving pole changer and means for controlling and operating the same.

852,523. AUTOMATIC TELEPHONE EXCHANGE; John G. Roberts. App. filed Feb. 5, 1906. Complete diagram of circuits for central exchange mechanism of automatic exchange.

852,536. RESISTANCE BOX FOR ELECTRICAL MEASUREMENTS; Frank Aronson, Evanston, Ill. App. filed Mar. 11, 1907. Mechanical details of a resistance box in which the contacts are made by sheet metal clips stamped into such a form as to produce sockets to receive the usual metal pins or plugs.



852,539.—Indicating Device for Electric Fuses or Cut-Outs.

852,537. CIRCUIT CONTROLLING MECHANISM FOR ELECTRICALLY HEATED TOOLS; William J. Barr, Cleveland, O. App. filed Apr. 19, 1906. A circuit controlling device for flat irons in which all the circuit connections are completed by a knife blade switch operated by a lever which extends alongside of the usual handle of the flat iron.

852,539. INDICATING DEVICE FOR ELECTRIC FUSES OR CUT-OUTS; Leonard B. Buchanan, Woburn, Mass. App. filed Dec. 17, 1906. In order to show when a fuse of cut-out has blown, patentee provides a small incandescent lamp in a shunt circuit around the fuse which glows in case the fuse burns out.

852,548. LIGHTNING CONDUCTOR; William P. Finn, Dansville, N. Y. App. filed Oct. 29, 1906. Features of a lightning conductor system for buildings by which the conductors extend over the building in the form of loops without any sharp angles.

852,569. SECONDARY BATTERY; Lamar Lyndon. App. filed June 3, 1905. An envelope for storage battery electrodes, comprising two porous diaphragms of vegetable matter, one being laid against each face of the electrode, in contact with the active material thereof, the edges of the diaphragm being inclosed in a flexible elastic frame to exclude the passage of electrolyte to the electrode, except through the pores of the said diaphragm.

852,572. LIGHTNING CONDUCTOR; William H. McCullough, Chicago, Ill. App. filed Nov. 1, 1906. A woven and braided cable having a tubular transverse section. Avoids sharp corners and provides for expansion and contraction of the conductor.

852,575. TELEPHONE EXCHANGE; Nils E. Norstrom, Chicago, Ill. App. filed Oct. 4, 1901. The combination with two branches of a circuit, and means for closing connections between said battery and said branches for the purpose of sending a series of impulses, of an electrically operated switching mechanism and a condenser in separate bridges between said branches.

852,582. ELECTROMAGNETIC SWITCH; Walter Scribner, Columbus, Ohio. App. filed Dec. 1, 1905. An end cell switch for storage batteries adapted to vary the number of cells so as to produce a uniform voltage on the lamp circuit. Has a special construction of ironclad magnet adapted to move a double throw knife blade switch.

852,628. AUTOMATIC ELECTRICAL TRAIN STOP; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Nov. 24, 1905. Relates to automatic train stops for use with railroad crossings. Circuits are adapted to set the train stops on one track when trains approach in either direction on the other track.

852,629. ELECTRICAL SWITCH LOCK FOR RAILWAYS; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Nov. 24, 1905. Provides means by which a train approaching a switch on the main line automatically locks the switch closed, and automatically releases the switch when the train reaches or passes the same.

852,630. RAILWAY SIGNAL; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Nov. 24, 1905. Relates to modifications of the above.

852,633. TRAIN STOPPING APPARATUS; Hiram G. Sedgwick, Mill Valley, Cal. App. filed June 14, 1906. A complete block signal system having sectional track rails energized by direct potential, and operating relays to set the semaphores when they are short circuited by the axles of a passing train.

852,634. ELECTRICAL TRAIN STOP; Hiram G. Sedgwick, Mill Valley, Cal. App. filed June 14, 1906. Additional features of the above.

852,635. AUTOMATIC ELECTRICAL TRAIN STOP; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Nov. 24, 1905. The locomotive has depending brushes or trolleys which complete circuits to the air brake apparatus so as to automatically stop the engine in case signals are disregarded.

852,639. ELECTRICAL SYSTEM OF DISTRIBUTION; William A. Turbayne, Lancaster, N. Y. App. filed July 25, 1906. Relates to electrical systems of distribution where a regulating battery is employed to steady the current or voltage of a main generator. Regulates the action of the battery by relatively varying the electromotive forces produced by two electric motors connected in series with each other.

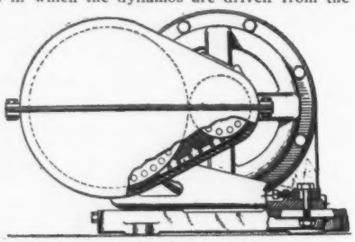
852,662. PROCESS FOR ELIMINATING THE ODORS OF FISH OILS; Alexandre De Hemptinne, Ghent, Belgium. App. filed Mar. 17, 1906. The process for eliminating the odor of fish oil which consists in subjecting the oil to the action of a silent electric discharge in a gaseous atmosphere.

852,675. TELEPHONE EXCHANGE; Nils E. Nostrom, Chicago, Ill. App. filed April 6, 1901. A telephone selecting switch provided with two contact strips, a movable contact maker, means whereby a movement of said contact maker in one direction will cause it to make a series of contacts with one of said strips, means whereby a pressure upon said contact maker will extend the contact of said contact maker to the other contact strip, and means whereby a movement of said contact maker in the opposite direction will act to prevent said contact maker from making contacts with either strip.

852,678. BACK-GEARED MOTOR; Henry G. Reist, Schenectady, N. Y. App. filed Sept. 21, 1906. Mechanical features of construction of motor adjustable on its base or support and having a gear or chain connection with a countershaft which is separately adjustable on the base or support.

852,686. BRUSH; G. A. Thornton, Schenectady, N. Y. App. filed Sept. 11, 1906. The method of securing a pig-tail to a brush, which consists in placing the end of the pig-tail between the brush and a gauze strip and securing the whole together by electroplating.

852,687. ELECTRICAL SYSTEM OF DISTRIBUTION; W. A. Turbayne, Lancaster, N. Y. App. filed July 25, 1906. Relates to lighting systems in which the dynamos are driven from the car axles and



852,678.—Back-Geared Motor.

a storage battery is used to equalize the potential. Has two electric motors in series, one having a substantially constant field strength and the other a field varied according to the variations for which regulation is to be provided.

852,690. REMOTE CONTROL DEVICE FOR ELECTRIC SWITCHES; G. Wright, Pittsfield, Mass. App. filed Apr. 12, 1905. Means for operating rheostats, regulators and the like, comprising a pair of solenoid connections and ratchet devices for engaging either of them selectively to a notched wheel. A locking device for the wheel is also provided.

852,691. CABLE BONDING DEVICE; H. E. Adams, Pittsburg, Pa. App. filed March 12, 1906. A device for bonding cables. A receptacle open at the top and bottom has end walls cut to fit upon the cable, and a strap by which it is attached. Lead or solder is poured into this receptacle.

852,700. AUTOMATIC DEVICE FOR PRODUCING INTERMITTENT MOTION; P. A. Brown, Denver, Colo. App. filed July 25, 1905. An electric motor has its circuit controlled by a thermostat having an arm vibrating between two points so that the motor circuit will be closed on movement of the arm in either direction. The motor is designed to make half a revolution on each circuit closure.

852,702. INDUCTION-MOTOR; Paul Bunet, Paris. App. filed July 12, 1906. In combination, a main induction motor having a coil-wound secondary member, an auxiliary induction motor mechanically connected thereto and having its primary member adapted for connection for a plurality of pole numbers and means for connecting the said primary with different pole numbers successively to the secondary of the main motor and for short-circuiting said secondary.

852,705. BRUSH HOLDER; F. M. Conlee, Madison, Wis. App. filed Sept. 11, 1906. A carbon brush is guided in a metallic frame and is impelled by a pivoted arm which in turn is engaged by a spring, so as to have a wide arc of movement.

852,708. ATTACHING PLUG AND RECEPTACLE; F. C. de Reamer, Schenectady, N. Y. App. filed Oct. 31, 1904. An attachment plug for branch circuits. The contacts are separated by an abrupt movement so as to avoid arcing.

852,711. TELEPHONE TRANSFORMER; John J. Frank, Schenectady, N. Y. App. filed Aug. 14, 1906. In a transformer, two cup-shaped members, a magnetic core clamped between said members and forming therewith an inclosing casing, primary and secondary windings on said core within the casing, the lower of said members being extended downwardly below said windings and provided with an opening at its bottom, and an insulating bushing extending through said opening and providing a passage for the primary leads of the transformer.

852,712. TRANSFORMER CORE; J. J. Frank, Schenectady, N. Y. App. filed Aug. 14, 1906. Construction of transformer having a laminated closed magnetic core with parallel legs joined by end pieces, the laminations composing said end pieces being of different widths.

852,724. DEVICE FOR ELECTRICALLY OPERATING BULKHEAD DOORS; D. R. Knapp, Philadelphia, Pa. App. filed Aug. 27, 1906. Devices for opening and closing bulkhead doors in ships. Motors that actuate the doors are put in operation in succession by means of a single main electric circuit that is common to all the motors.

852,728. AUTOMOBILE CONTROL; H. Lemp, Lynn, Mass. App. filed Oct. 11, 1905. Relates to the control of automomiles of the type in which the driving wheels are independently rotatable and driven by independent series-wound motors. It is designed to prevent the skidding of the wheels by reason of varying torque in the motors of varying road conditions for the respective wheels.

852,730. INSULATOR; F. M. Locke, Victor, N. Y. App. filed Nov. 16, 1903. An insulator of the type having a saddle to receive the cable. Covers details of the connection between the pin and the insulator by which a space is provided at the base of the pin to prevent burning out.

852,732. ELECTRIC HEATER FOR METAL WORKERS; J. O. Luthy, Austin, Tex. App. filed Feb. 1, 1906. A tank is filled with sal ammoniac solution and has a carbon plate forming one electrode. Iron rods may be heated by completing the circuit between said solution and an exterior circuit terminal through the rod to be heated.

852,766. AUTOMATIC ELECTRICAL CUT-OUT DEVICE; R. Brebach, Leipzig-Reudnitz, Germany. App. filed July 21, 1904. Automatic electric cut-out having a separate lever connection between the armature and the movable switch element.

852,773. ELECTROTHERMOSTATIC HEAT REGULATORS; L. G. Copeman, Spokane, Wash. App. filed May 21, 1906. Flat-iron is constructed with a resistance element and a thermostat so that the current is automatically cut off when a certain degree of heat is obtained.

852,778. ELECTRIC CABLE; R. D'Unger, Chicago, Ill. App. filed Sept. 19, 1904. A series of electric conductors are formed into continuous adjacent circuits part of each two adjacent circuits being wound upon a common core, and an additional circuit is associated therewith having a part wound on each of said cores.

852,806. LOCKING DEVICE FOR TELEPHONES; Francis S. K. Smith and David C. Reinchl, Washington, D. C. App. filed Sept. 5, 1906. A telephone apparatus comprising a column provided with a slot, a receiver-hook in said slot, a flexible annular band engaging the column and the receiver-hook and a lock engaging the band.

852,851. MOTOR CONTROLLING RHEOSTAT; F. J. Seabolt, Schenectady, N. Y. App. filed Jan. 14, 1907. A starter for electric motors having two separate series of resistance contacts. Provides means whereby one resistance is short-circuited while the other is being varied.

852,853. ELECTRICAL HEATER; M. H. Shoenberg, San Francisco, Cal. App. filed Sept. 13, 1906. A flat plate of porcelain is spirally wound with a resistance wire so as to form a resistance element adapted to be imbedded in a hollow flat iron.

852,854. ELECTRICAL FLUID HEATER; M. H. Shoenberg, San Francisco, Cal. App. filed Sept. 13, 1906. A fluid heating apparatus comprising a cylindrical casing adapted to be attached to the bottom of a tank containing liquid. This casing is surrounded by a resistance wire and has passages by which a circulation of the liquid is obtained therethrough.

852,926.—ELECTRIC TOOL DRIVER; A. F. Carver and J. N. Stout, New York, N. Y. App. filed Dec. 21, 1905. An electric hammer having a solenoid and a plunger longitudinally movable therein; relates to various features of construction including a dash pot having a reciprocating piston in position to receive the impact of the hammer on its return stroke.

852,927. ELECTRICALLY ACTUATED SIGNAL BELL; H. W. Eden, Detroit, Mich. App. filed July 18, 1906. A bearing for the trunnion of the armatures of electric bells consisting of a center strip of metal bent to form the lower and the upper bearings thereof as well as form a brace by which they are rigidly supported.

852,960. TROLLEY CIRCUIT FORMER; G. R. Livergood, St. Joseph, Mo. App. filed Jan. 29, 1906. A lever adapted to be periodically displaced in passing suitable projections, so as to close the circuit for a sign actuator in the car.

852,978. TROLLEY; A. J. Reif and A. L. McCormick, Allegheny and Knoxville, Pa. App. filed June 2, 1906. A construction of harp having spring arms or hooks which close over the trolley wheel to hold the wire, but separate in passing the hangers.

853,001. TREMBLER FOR INDUCTION COILS; C. H. Bryant, Hammersmith, Eng. App. filed Apr. 23, 1906. The armature is held upon the trembler by spring connection so as to have an independent movement. The contacts are designed to have their pressure varied to change the resistance rather than actually interrupt the circuit.

853,002. TELEPHONE SYSTEM; Edward J. Burke, Brooklyn, N. Y. App. filed Oct. 14, 1905. In a multiple board central system the combination of a plurality of subscribers' stations, a plurality of jacks connected together and to each of the said subscribers' stations by a single line, a pair of floats connected together by a single strand, a lamp associated with each of the said sets of jacks and means for causing the said lamps to produce lights of different characters to indicate when a connection is desired and when the conversation is completed.

853,107. METHOD OF OPERATING ELECTRIC MOTORS; Ralph D. Mershon, New York, N. Y. App. filed Feb. 14, 1904. The method of operating a motor provided with a commutator, which consists in running the motor, with the commutator, at a maximum number of poles, allowing its speed to approximate synchronism for such number of poles, short-circuiting the armature winding or windings, and thereafter varying the number of poles.

853,126. RAIL SPREAD INDICATING DEVICE; J. A. Shires, Denver, Col. App. filed Oct. 31, 1906. A pair of pins are suspended from a beam beneath the car and just outside of the track rails. In case of spreading of the rails the pins are separated and close an alarm circuit.

853,033. PORTABLE ELECTRIC LIGHT CABINET; H. G. Roberts, Lexington, Ky. App. filed July 11, 1906. A therapeutic apparatus having a number of lamps of different colors and means by which different lamps may be illuminated by pressing different buttons on the cabinet.

853,096. DEPILATORY INSTRUMENT; H. H. Lewis, Louisville, Ky. App. filed June 16, 1906. Circuit is made between a needle and a pair of prongs immediately adjacent thereto and slightly behind its apex.

853,106. ALTERNATING-CURRENT APPARATUS; Ralph D. Mershon, New York. App. filed April 10, 1907. In alternating current apparatus, the combination with the primary element and means for varying the number of poles therein, of a secondary element having the width of its circuits proportioned, as to the arcs embraced thereby, to produce a predetermined flux wave therein with the magnetic flux distribution in the primary for one of the possible number of poles as set forth.